

APPENDICES

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ENERGY ENGINEERING ANALYSIS PROGRAM

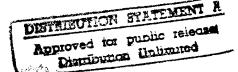
ENERGY SURVEY OF ARMY INDUSTRIAL FACILITIES

WESTERN AREA DEMILITARIZATION FACILITY HAWTHORNE ARMY AMMUNITION PLANT HAWTHORNE, NEVADA

19971017 062

VOLUME II

PREPARED FOR



DEPARTMENT OF THE ARMY SACRAMENTO DISTRICT, CORPS OF ENGINEERS SACRAMENTO, CALIFORNIA

PREPARED BY

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EEAP Energy Survey of Army Industrial Facilities Western Area Demilitarization Facility, HWAAP, Nevada

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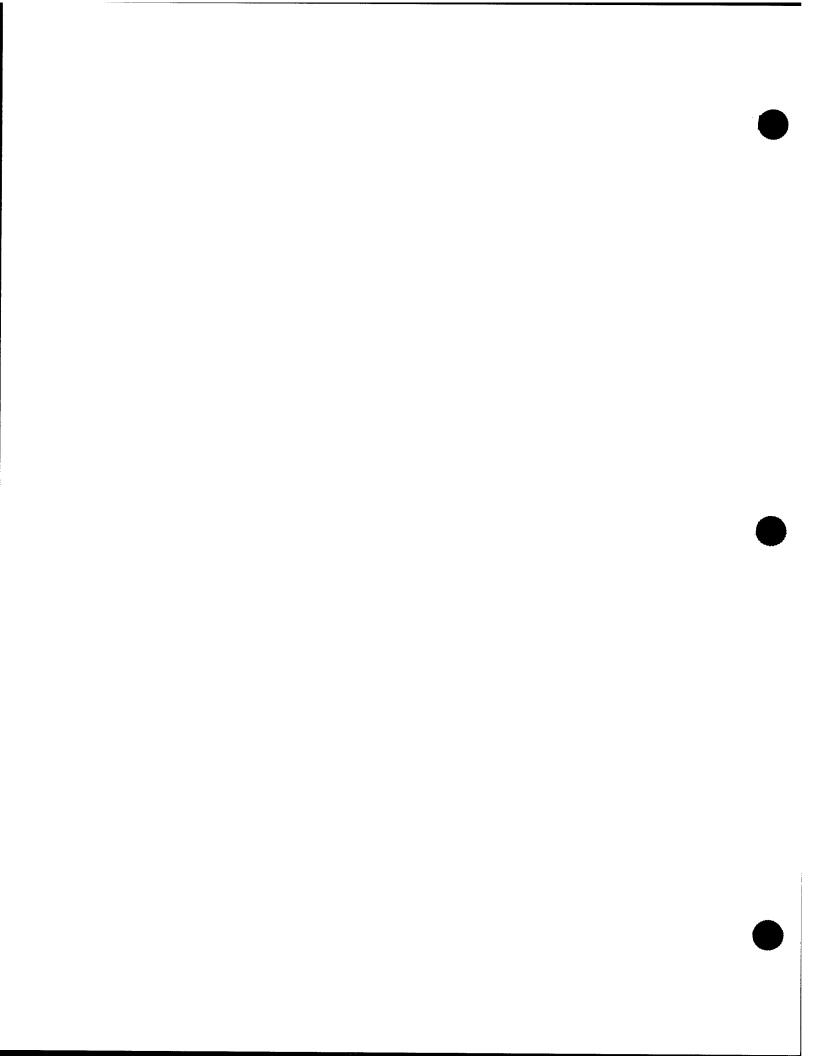
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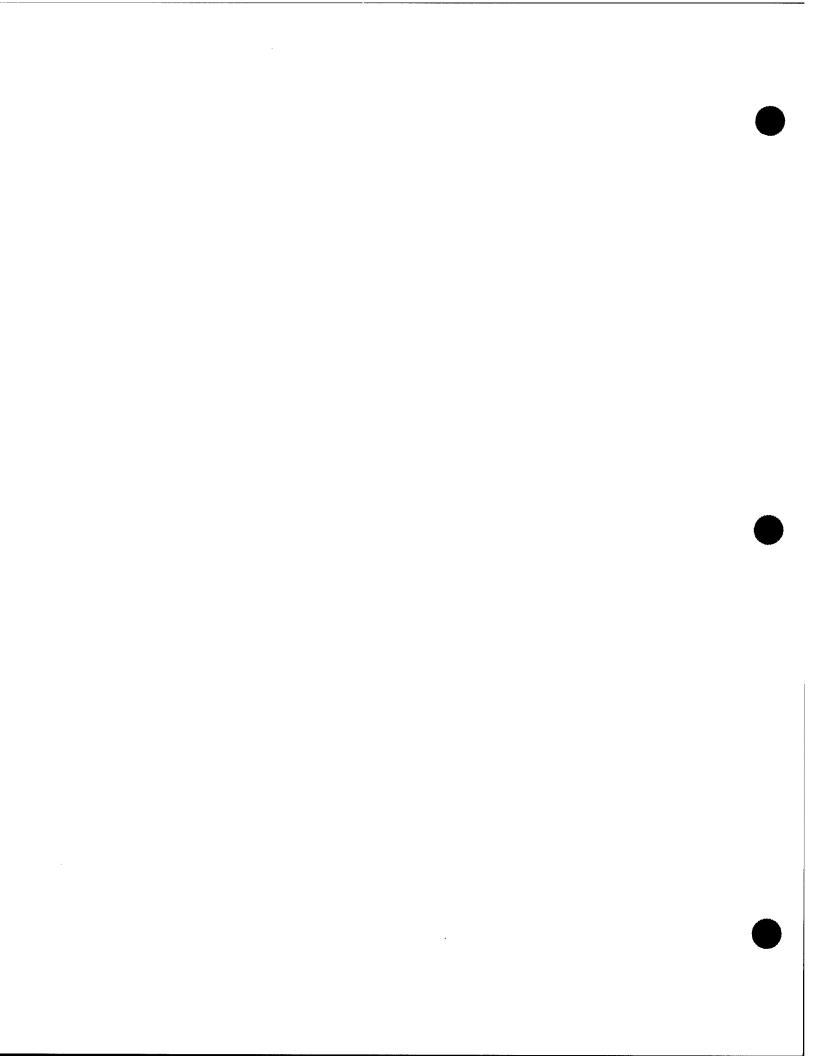


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EEAP Energy Survey of Army Industrial Facilities Western Area Demilitarization Facility, HWAAP, Nevada

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WADF Steam System

Building 117-2 houses the central steam plant serving WADF facilities. The steam plant was originally designed and constructed under requirements for dual fuel firing, one of which was required to be coal. The smallest dual fuel capable boilers available at that time were installed. The three Keeler 50,000 PPH steam boilers do not "turn-down" well (low load efficiencies are much lower than efficiencies at greater loads) and have never been operated after their initial acceptance testing. They have been, and remain, "mothballed".

When the WADF was placed into operation several years ago, a packaged fire tube boiler was installed in the boiler plant to provide steam service only to WADF facilities at high efficiency. The boiler is located in the service bay at the North-West corner of the building and utilizes the deaerating Feedwater Heater and other ancillary equipment installed to serve the three 50,000 PPH coal fired steam boilers.

Boiler Cleaver-Brooks input (DF-2): 16,738 MBH

Model: CB 100-400 119.5 Gallons per Hour No. 2 Fuel Oil

S/N: L-89956 Blower Motor: 15 HP Rated: 150 psi Air Compressor: 5 HP

Dated: 8/23/91 Primary Safety Controls: 4D

Deaerating Feedwater Heater

Cleaver-Brooks

Model: 8M-100 S/N: D3-1935

Capacity: 100,000 PPH Shipped: 7/23/76

Steam is distributed via surface and underground piping to WADF buildings. The system is shown schematically on Figure E-1.

Recommendations for Central Steam Plant and Distribution System Energy Conservation

During field investigations of the steam plant and distribution systems, several significant deficiencies were noted.

<u>Deaerating Feed Water Heater</u> is sized for the three large coal fired boilers. Consider replacing this unit with one properly sized for the smaller packaged steam boiler system.

<u>Steam Pressure</u> is higher than is needed. Building steam usage is for HVAC and WADF process use. The HVAC utilization pressure is about 40 psig; WADF processes require only 15 psig steam. Consider reducing steam pressure to the minimum needed to serve requirements.

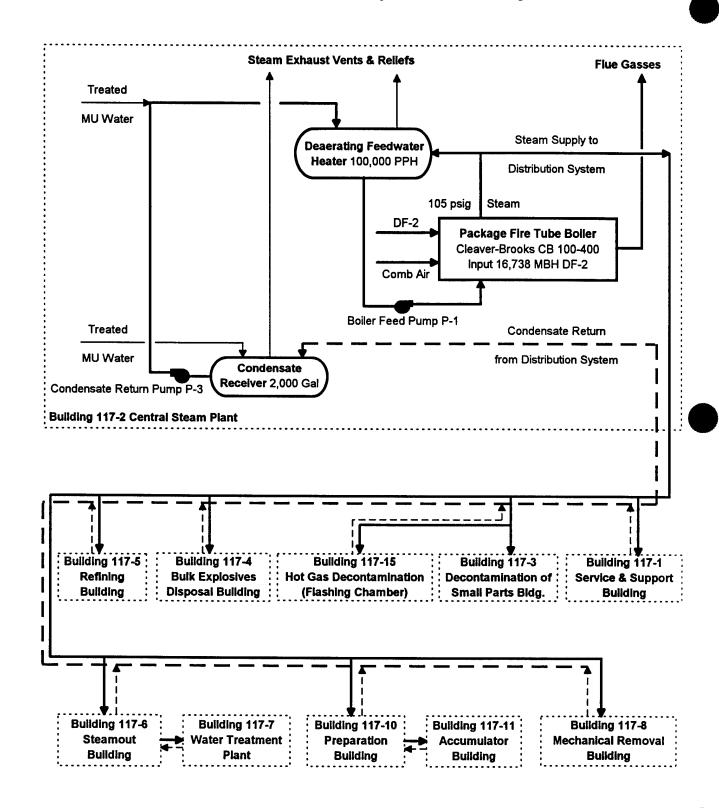
Flue temperature was measured at about 370°F; consider installing a stack economizer system.

Boiler combustion efficiency was measured at only 78%, much lower than is achievable with this type boiler. Consider installation of <u>Automatic Oxygen Trim Combustion Controls</u> or conduct <u>more frequent boiler tune-ups</u>.

<u>Almost no condensate is returned</u> from WADF buildings. Process uses of steam require contact with explosives for most uses, thus, no condensate is returned from them.

HVAC steam usage should provide significant condensate return. Field investigation of condensate return systems in WADF building mechanical room steam pits found only a single system operating; almost every condensate receiver-pump set was found to be non-functional. Consider repairing and/or replacing all the condensate receiver-pump sets.

Figure E-1. WADF Steam Distribution System Schematic Diagram



Central Steam Plant Efficiency (Building 117-2)

Date/Time Total Water

Combustion Efficiency measured using a Beckett C5 Oxygen Analyzer; readings:

11.65% Oxygen 375 °F = 78.0% Combustion Efficiency for No. 2 Fuel Oil

in-Plant Losses:

Radiation Losses	-2.50%
Shutdown Losses	-2.00%
Insulation (Convection) Losses	-2.00%
General Condition Losses	-2.00%

Leakage:

Several significant steam leaks were observed on exterior steam distribution piping. Most steam traps in non-process applications are not functioning well, and many leaks were observed in building mechanical room steam systems. In addition, only one of the condensate receiver / pump installations is working properly.

Leakage is quantified by observing make-up water and fuel consumption records for the past several months of operations. No processing takes place on most Sundays. The steam boilers are kept on line since they will be needed again in less than 24 hours following the last Saturday shift. Fuel and make-up water useage are shown on Figure E-2 and on Table E-1.

Sunday Make-up Water and Fuel consumption gallons per day from Table E-1 are:

Eucl

Date/ I Ime	<u>i otai water</u>	<u>Fuel</u>	
5-Jun	130	647	Boiler Plant Shut Down
12-Jun	5,800	778	MU water too high for no processing, heating needed?
19-Jun	4,680	490	
26-Jun	4,030	631	
3-Jul	0	154	Boiler Plant Shut Down
10-Jul	3,960	729	
17-Jul	3,450	639	Average Make-up Water: 4,101 gallons/day
24-Jul	4,080	676	
31-Jul	4,320	238	Average Fuel Usage: 566 gallons/day
7-Aug	4,190	559	
14-Aug	5,230	652	MU water too high for no processing, heating needed?
21-Aug	5,240	650	MU water too high for no processing, heating needed?
28-Aug	6,570	826	MU water too high for no processing, heating needed?
4- Sep	2,350	440	MU water too high for no processing, heating needed?
11-Sep	8,700	1,035	MU water too high for no processing, heating needed?

4,101 gallons water is lost daily due to leaks (nic process steam consumption).

6,581 gallons water is consumed daily, on the average, thus, the above loss represents 62.3% of overall water makeup needs. The remainder, about 2,480 gallons

per day (average) represents steam consumed for demilitarization processes and for building HVAC uses. Process steam usage consumes the steam without condensate return. Condensate return systems serving building HVAC systems are inoperative. Thus, no condensate is returned to the steam plant. Since the above data is from the non-heating season, the 2,480 gallons per day of makeup water not attributed to leaks is assumed to be process steam consumption.

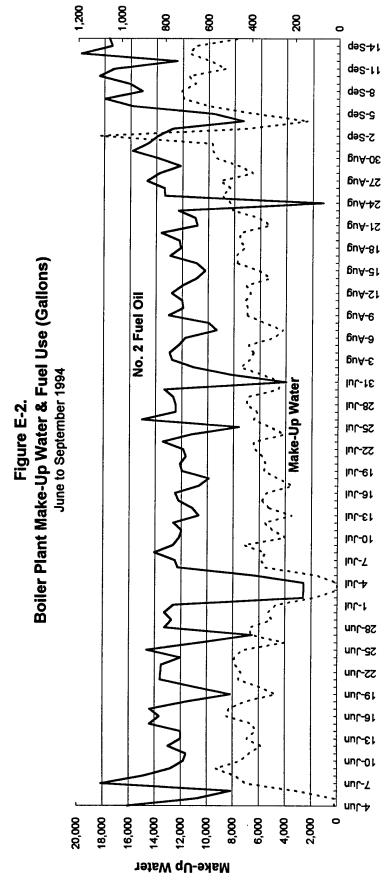
Efficiency: Based on raw water at 50°F and condensate return normally at 200°F, leakage represents a loss of about 150 BTU/lb. Heat required to produce 105 psig saturated steam from condensate at atmospheric pressure and 200°F is about 985 BTU/lb. Thus loss of the above percentage of condensate represents a boiler plant efficiency loss of:

9.49%.

Overall Steam Plant Efficiency =

60.0% (up to individual building mechanical rooms)5.0% additional losses assumed in each building mechanical room

55.0% Used for HVAC system modification evaluations, see Appendix D.



No. 2 Fuel Oil

Table E-1. Building 117-2 Boiler Plant Make-Up Water Usage and Fuel Consumption

Date/Time	0400	0530	0700	1230	1630	2000	Total Water	Fuel	Day
4-Jun	30	40	40	30	40	10	190	966	Sat
5-Jun	20	30	10	30	20	20	130	647	Sun
6-Jun	10	30	20	30	1,640	1,360	3,090	488	Mon
7-Jun	1,160	1,620	1,020	1,410	1,050	740	7,000	1,086	Tue
8-Jun	1,210	1,230	1,190	1,740	940	1,490	7,800	892	Wed
9-Jun	1,430	1,220	1,890	2,150	850	1,760	9,300	767	Thur
10-Jun	1,200	1,420	1,280	1,450	620	1,420	7,390	708	Fri
11-Jun	990	1,370	1,170	1,380	680	1,140	6,730	695	Sat
12-Jun	1,140	1,170	790	1,180	680	840	5,800	778	Sun
13-Jun	570	1,190	1,250	880	1,390	1,640	6,920	721	Mon
14-Jun	850	1,130	1,030	2,080	630	530	6,250	720	Tue
15-Jun	1,140	1,400	120	1,200	1,360	1,200	6,420	863	Wed
16-Jun	1,320	1,350	1,100	2,180	1,120	1,390	8,460	818	Thur
17-Jun	1,420	1,410	1,760	950	980	1,790	8,310	862	Fri
18-Jun	1,130	860	1,490	1,490	590	1,480	7,040	692	Sat
19-Jun	610	1,300	610	1,100	270	790	4,680	490	Sun
20-Jun	790	940	970	760	840	1,590	5,890	654	Mon
21-Jun	660	1,560	2,600	2,010	750	- 1,000	7,580	816	Tue
22-Jun	1,460	1,150	1,280	870	1,210	1,400	7,370	813	Wed
23-Jun	1,020	1,600	2,440	1,110	1,610	-	7,780	809	Thur
24-Jun	1,080	1,410	1,210	1,170	1,270	1,740	7,880	721	Fri
25-Jun	1,090	1,440	2,070	590	1,430	620	7,240	876	Sat
26-Jun	980	-	-	-	2,510	540	4,030	631	Sun
27-Jun	1,150	510	1,410	810	1,610	1,120	6,610	390	Mon
28-Jun	1,250	1,360	990	1,060	1,140	940	6,740	795	Tue
29-Jun	940	900	670	1,020	590	870	4,990	763	Wed
30-Jun	930	860	1,030	880	630	990	5,320	797	Thur
1-Jul	1,010	950	670	770	570	720	4,690	755	Fri
2-Jul	510	580	480	190	-	-	1,760	158	Sat
3-Jul	-	-	-	-	-	-	<u>o</u>	154	Sun
4-Jul	-	-	-	-	-	-	Ō	154	Mon
5-Jul	-	•	-	-	400	1,150	1,550	386	Tue
6-Jul	900.00	810	1,200	680	700	1,190	5,480	736	Wed
7-Jul	810	1,140	880	920	980	1,120	5,850	749	Thur
8-Jul	950	1,350	840	640	770	980	5,530	843	Fri
9-Jul	990	1,060	640	3,430	400	630	7,150	758	Sat
10-Jul	890	900	350	810	410	600	3,960	729	Sun
11-Jul	480	640	760	890	1,030	1,130	4,930	718	Mon
12-Jul	650	1,370	1,100	590	1,000	900	5,610	756	Tue
13-Jul	410	600	690	300	560	920	3,480	639	Wed
14-Jul	830	920	780	880	770	1,070	5,250	670	Thur
15-Jul	900	1,050	740	990	880	1,240	5,800	733	Fri
16-Jul	610	1,310	870	990	690	990	5,460	748	Sat
17-Jui	290	1,080	300	670	430	680	3,450	639	Sun
18-Jul	310	890	550	790	960	1,030	4,530	593	Mon
19-Jul	640	1,160	870	970	870	1,150	5,660	717	Tue
20-Jul	730	1,320	810	830	740	1,080	5,510	726	Wed
21-Jul	870	1,110	890	930	840	1,120	5,760	699	Thur
22-Jul	860	1,150	710	1,080	1,060	1,510	6,370	712	Fri
22 11	510	1,170	1,250	1,140	750	1,630	6,450	805	Sat
23-Jul									
23-Jul 24-Jul	500	900	590	990	330	770	4,080	676	Sun

Table E-1. Building 117-2 Boiler Plant Make-Up Water Usage and Fuel Consumption

Date/Time	0400	0530	0700	1230	1630	2000	Total Water	Fuel	Day
26-Jul	960	1,250	750	1,230	1,090	1,170	6,450	901	Tue
27-Jul	880	1,350	840	950	1,090	1,070	6,180	749	Wed
28-Jul	860	1,760	880	1,110	1,020	1,380	7,010	747	Thur
29-Jul	890	1,550	1,240	1,160	990	1,090	6,920	759	Fri
30-Jul	610	960	820	940	490	760	4,580	800	Sat
31-Jul	600	1,040	420	900	610	750	4,320	238	Sun
1-Aug	680	890	920	1,080	1,010	1,190	5,770	493	Mon
2-Aug	970	1,750	920	1,070	1,100	1,660	7,470	662	Tue
3-Aug	790	1,380	1,180	930	1,200	1,260	6,740	764	Wed
4-Aug	1,250	1,350	1,330	-	1,030	1,520	6,480	776	Thur
5-Aug	930	1,380	990	1,270	1,430	870	6,870	734	Fri
6-Aug	650	1,210	720	1,000	360	950	4,890	703	Sat
7-Aug	650	1,030	360	840	590	720	4,190	559	Sun
8-Aug	580	930	670	1,100	1,000	1,310	5,590	596	Mon
9-Aug	720	1,450	1,330	1,150	1,010	1,320	6,980	781	Tue
10-Aug	890	1,310	940	1,260	1,000	1,550	6,950	713	Wed
11-Aug	1,070	1,430	1,200	1,500	570	1,350	7,120	720	Thur
12-Aug	1,210	1,570	190	1,320	1,070	1,370	6,730	767	Fri
13-Aug	1,100	1,480	1,040	1,240	920	1,280	7,060	718	Sat
14-Aug	790	1,270	550	1,040	680	900	5,230	652	Sun
15-Aug	470	1,320	770	1,340	1,200	1,000	6,100	613	Mon
16-Aug	1,130	1,280	1,070	1,530	1,210	1,530	7,750	652	Tue
17-Aug	970	1,640	1,170	1,150	1,590	1,310	7,830	775	Wed
18-Aug	910	1,310	1,050	1,410	1,090	1,390	7,160	725	Thur
19-Aug	1,070	1,290	1,280	1,270	1,150	1,500	7,560	733	Fri
20-Aug	1,160	2,880	1,260	1,100	-	1,160	7,560	815	Sat
21-Aug	-	-	2,390	1,300	830	720	5,240	650	Sun
22-Aug	790	1,040	980	850	1,290	1,170	6,120	660	Mon
23-Aug	1,250	1,500	1,190	1,470	1,070	1,620	8,100	737	Tue
24-Aug	1,200	1,870	1,200	1,350	1,420	1,260	8,300	71	Wed
25-Aug	1,270	1,460	1,000	1,790	1,190	2,240	8,950	800	Thur
26-Aug	680	1,570	1,180	1,630	1,330	1,910	8,300	802	Fri
27-Aug	1,150	1,770	1,220	1,560	1,020	2,390	9,110	883	Sat
28-Aug	1,210	1,430	1,020	1,280	670	960	6,570	826	Sun
29-Aug	1,020	1,140	1,310	1,500	1,280	1,430	7,680	728	Mon
30-Aug	1,470	1,730	1,340	1,640	1,110	2,070	9,360	832	Tue
31-Aug	1,160	1,660	1,940	1,650	1,120	2,140	9,670	950	Wed
1-Sep	870	1,870	1,980	1,590	910	2,480	9,700	880	Thur
2-Sep	9,530	420	740	2,160	3,000	2,440	18,290	835	Fri
3-Sep	2,560	550	850	980	2,070	•	7,010	764	Sat
4-Sep	370	360	340	520	390	370	2,350	440	Sun
5-Sep	380	710	890	1,700	1,150	1,610	6,440	577	Mon
6-Sep	260	2,110	1,980	2,050	1,530	2,070	10,000	951	Tue
7-Sep	1,620	2,390	2,470	1,800	1,700	1,930	11,910	1,077	Wed
8-Sep	2,060	2,320	1,780	2,160	2,230	1,540	12,090	906	Thur
9-Sep	2,030	2,120	1,560	2,230	1,450	1,620	11,010	963	Fri
10-Sep	1,810	2,520	1,840	2,410	1,150	1,800	11,530	1,102	Sat
11-Sep	1,410	1,900	2,070	890	890	1,540	8,700	1,035	Sun
12-Sep	1,140	1,560	1,555	2,390	1,700	1,500	9,845	745	Mon
13-Sep	2,000	2,170	2,210	1,550	1,410	2,130	11,470	1,187	Tue
14-Sep	1,490	2,120	2,320	1,670	1,510	1,960	11,070	1,044	Wed
15-Sep	1,800	2,420	1,730	1,760	•	-	7,710	1,057	Thur
					1		·		

Table E-2. Summary of Central Steam Plant and Distribution System Energy Conservation Opportunities

	Energ	Energy Savings		Energy C	Energy Cost Savings	<u>s</u>	% ⊗ ⊗	O & M Savings	Total	Total Savings
Description of Energy	Electric	Fuel Oil	Electric		Energy	Energy	Savings	Savings Savings	Annual	Annual Life Cycle
Conservation Opportunity	kWH/Yr Million	Million BTU/Yr	3TU/Yr \$/Year	\$/Year	\$/Year	\$CC\$	\$/Year LCC\$	SCC\$	\$/Year	\$CC
Central Steam Plant and Distribution System Energy (on System	Energy Conser	vation Op	Conservation Opportunities	s					
Replace Building Condensate Return	,	;	•							
Systems	0	1,100	80	\$6,743	\$6,743	\$95,957	\$	\$	\$6,743	\$95,957
Reduce Steam Pressure, Install New	0	21,218	\$0	\$130,030	\$130,030	\$130,030 \$130,030 \$1,850,332 (\$2,714) (\$32,402) \$115,725 \$1,687,577	(\$2.714)	(\$32.402)	\$115.725	\$1.687.577
Deaerator, and Repair Steam Leaks Note: This ECO includes equipment replacement costs at 5 and 10 years at present value of:	Note: This	S ECO includes e	quipment	replaceme	nt costs at 5	and 10 years	s at presen	t value of:	•	\$57,961
Install Oxygen Trim Combustion	(600'8)				0					
Controls & Flue Economizer	(0.91)kW	1,435	(\$444)	(\$444) \$8,792	\$8,348	\$119,770 (\$2,501) (\$29,856)	(\$2,501)	(\$29,856)	\$5,847	\$89,914
Summary Central Steam Plant	(000 0)	20 150	(1,1,4)	100	707 2770	0000				
Energy Conservation Opportunities	(a)n(a)	23,733	(4444)	\$145,565	\$145,121	(**************************************	(\$5,214)	(\$62,258)	\$128,315	\$1,873,447

	Retrofit	Econom	Economic Analysis	
Description of Energy	Investment	0	Раураск	
Conservation Opportunity	•	<u> </u>	Years	
Replace Building Condensate Return	000	,	6.0	
Systems	\$04,200	4.	9.52	
Reduce Steam Pressure, Install New	700	0	į	
Deaerator, and Repair Steam Leaks	\$202,624	8.33	1.75	
Install Oxygen Trim Combustion		•	,	
Controls & Flue Economizer	\$20°,280	1.49	10.31	
Summary Central Steam Plant	407	1	L C	
Energy Conservation Opportunities	\$327,10 4	5.73	7.55	

Life Cycle Cost Analysis Summary **Energy Conservation Investment Program (ECIP)**

Location: Hawthorne Army Ammunition Plant Region No. 4 Project No. Western Area Demilitarization Facility (WADF), Nevada Project Title: **ECIP Facility Energy Improvements** Fiscal Year FY97 Replace Condensate Receiver / Return Pump Sets in WADF Buildings, Reduce Steam Pressure, Install New Deaerator, and Repair Steam Leaks, & Install Flue Economizer and Oxygen Trim Combustion Controls Analysis Date: November 1994Economic Life: 15 Years Preparer: KELLER & GANNON 1. Investment Costs A. Construction Costs \$292,057 B. SIOH 17,523 C. Design Cost \$ 17,523 D. Total Cost (1A + 1B + 1C) \$ 327,104 E. Salvage Value of Existing Equipment \$0 F. Public Utility Company Rebate \$0 G. Total Investment (1D-1E-1F) \$327,104 2. Energy Savings (+)/Cost(-): Date of NISTIR 85-3273 Used for Discount Factors: October 1994 Energy Cost Saving Annual \$ Discount Discounted Source \$/MBTU(1) MBTU/Yr(2) Savings(3) Factor(4) Savings(5) A. Elec. \$12.82 (27.33)(\$350)12.02 (\$4,212)B. Dist \$6.13 23,753 \$145,565 14.23 \$2,071,394 C. LPG D. Other E. Elec Demand \$102.21 (0.9)(\$93)12.02 (\$1,123)F. Total 23.725 \$145,121 \$2,066,059 3. Non Energy Savings (+) or Cost (-): A. Annual Recurring (+/-) (\$5,214) (1) Discount Factor (Table A) 11.94 (2) Discounted Savings/Cost (3A x 3A1) (\$62,258)B. Non Recurring Savings (+) or Cost (-) Item Savings(+) Year of Discount Discounted Occur. (2) Cost(-)(1) Factor(3) Savings(+) Cost(-) a. (\$57,961) 5 0.863 (\$50,020) 10 b. (\$57,961) 0.744 (\$43,123) (\$57,961) 15 0.642 C. (\$37,211) d. Total (\$173,882) (\$130,354) C Total Non Energy Discounted Savings (3A2+3Bd4) (\$192,611)4. First Year Dollar Savings (2F3+3A+(3Bd1/Years Economic Life)): \$128,315 5. Simple Payback (1G/4): 2.55

Years

\$1,873,447

5.73

6. Total Net Discounted Savings (2F5 + 3C):

7. Savings to Investment Ratio (SIR) 6/1G:

WADF Building HVAC System Condensate Return System Replacement

HVAC energy usage is estimated for selected WADF buildings in Appendix D where HVAC control system, building envelope and heat recovery energy saving projects are evaluated. Results of these simulations are:

Building Number	Description	Electric kWH/Yr	Fuel Oil k BTU/Yr	Includes consideration of the following ECOs with SIRs > 1
117-1	Services & Supply	91,447	639,767	DDC Controls Retrofit
117-2	Central Heating Plant	NA	NA	NA
117-3	Decontamination of Small Parts	104,029	1,060,060	DDC Controls Retrofit
117-4	Bulk Explosives Disposal	69,400	783,096	DDC Controls Retrofit
117-5	Refining Building	90,697	868,975	DDC Controls, Ht Recovers & Air Curtains
117-6	Steamout Building	152,601	1,470,778	DDC Controls, Ht Recovers & Air Curtains
117-6A	Water Booster Pump Building	NA	NA	NA
117-7	Process Water Treatment Building	NA	NA	NA
117-8	Mechanical Removal Building	60,908	609,765	DDC Controls Retrofit
117-10	Preparation Building	78,614	1,316,319	
117-11	Accumulator Building	Included w	ith 117-10 re	
117-15	Flashing Chamber	NA	NA	NA
Total Esti	mated HVAC Energy Usage	647,695	6,748,760	with successful HVAC ECOs

HVAC Fuel Oil consumption includes losses from condensate that could have been returned to the central steam plant, but is not because of inoperative equipment.

The plant efficiency used to determine the above heating energy use:

55%

Thus, the heating load, or steam energy consumption is:

3,712 Million BTU/Year.

Steam is distributed at 105 psig, is reduced through pressure regulating valves to 40 psig and is then condensed in heat exchangers to heat a water-ethylene glycol mixture for circulation through heating coils and convectors. Enthalpies of the steam, condensate and raw water are as follows:

	Total enthalpy	h _{f-g}
Saturated steam, 105 psig =	1,190 BTU/Lb	878
Saturated Steam, 40 psig =	1,176 BTU/Lb	920
Liquid, 200°F =	168 BTU/Lb	
Liquid, 50°F =	18 BTU/Lb	

Steam generated to satisfy the HVAC heating loads is:

4,034,585 Pounds per Year.

Heat lost from condensate not returned is, thus:

605 Million BTU/Year

Equivalent fuel consumption, per existing boiler efficiency

1,100

Million BTU/Year No. 2 Fuel Oil

Electric usage is assumed to remain the same as existing because existing condensate receiver-pump systems are energized, but are leaking into the steam pit sump. A small amount of additional electric power consumption is expected, however, it is not likely to be significant.

Operations and maintenance expenses are expected to be the same as for the existing system.

Life Cycle Cost Analysis Summary Energy Conservation Investment Program (ECIP)

Location:		y Ammunition Pla emilitarization Fac	nt Region No. 4	Project No.	
Project Title:		ergy Improvement	•		FY97
	Replace Condens	ate Receiver / Retu	m Pump Sets in WA	NDF Buildings	
Analysis Date:	November 1994	Economic Life:	15 Years	Preparer: KELL	ER & GANNON
1. Investment	Costs				
A. Construction	n Costs		\$57,322		
B. SIOH			\$ 3,439		
C. Design Cos			\$ 3,439		
D. Total Cost			\$ 64,200		
	lue of Existing Eq			<u> </u>	_
	y Company Rebat	е		\$0	_
G. Total Inves	tment (1D-1E-1F)				\$64,200
2. Energy Sav	ings (+)/Cost(-):				
Date of NISTIF	R 85-3273 Used 1	or Discount Facto	ors: October 1994	1	
Energy	Cost	Saving	Annual \$	Discount	Discounted
Source	\$/MBTU(1)	MBTU/Yr(2)	Savings(3)	Factor(4)	Savings(5)
A. Elec.	\$12.82	0.0	\$ O	12.02	\$0
B. Dist	\$6.13	1,100	\$6,743	14.23	\$95,957
C. LPG	-	-	•		,
D. Other	-				
E. Elec Deman	d \$102.21				
F. Total		1,100	\$6,743		\$95,957
3. Non Energy	Savings (+) or C	ost (-):			
A. Annual Rec	urring (± /-)		\$ 0		
	actor (Table A)			11.94	
	Savings/Cost (3/	A x 3A1)		11.54	\$ 0
(_,					70
B. Non Recurri	ng Savings (+) o	r Cost (-)			
Item	Savings(+)	Year of	Discount	Discounted	
	Cost(-)(1)	Occur. (2)	Factor(3)	Savings(+) Co	st(-) (4)
a.		0	1.00	\$0	, , , , , , ,
b.					
C.					
d. Total	\$0			\$0	
C Total Non Er	nergy Discounted	Savings (3A2+3	Bd4)	\$ 0	
4. First Year D	ollar Savinos (2F:	3+3A+(3Rd1/Ye	ars Economic Life)): \$6,743	
5. Simple Payl	-	(050 1/16	J	9.52	Years
	iscounted Savings	s (2F5 + 3C):		\$95,957	i cai s
	nvestment Ratio			1.49	
		, = , - , - , - , - , - ,		1.70	

				Date Prepared	1	Sheet	of
CONSTRUCTION CO	ST ES	AMIT	TE	Noven	nber-94	1	1
Project			***************************************	Project No.	Basis for Est	imate	
ECIP Facility Energy Imp							
Location Western Area Demili	itarizati	on Fac	ility (W	ADF)			
Hawthorne Army Amm	unition	Plant,	Nevada		Code A (no	design compet	ted)
Engineer-Architect Keller & Gannon							
Drawing No.		Estimator			Checked By		
Replace Condensate Return Sy	ystems		B. I. Ho	orst		R. C. Len	nia
	Qui	antity		Labor	Ma	aterial	I
Line Item	No.	Unit	Per		Per		Total
	Units	Meas.	Unit	Total	Unit	Total	Cost
Simplex Condensate Return System, pump, motor, float switch, controls, cast iron receiver	14	EA	\$609	\$8,533	\$1,099	\$15,379	\$23,912
Duplex Condensate Return System, 2 pumps, motors, float switch, alternator assembly, cast iron rcvr	1	EA	\$1,219	\$1,219	\$2,953	\$2,953	\$4,172
Miscellaneous Piping and Insulation Repairs, per System	15	EA	\$609	\$9,142	\$203	\$3,044	\$12,186
Subtotal				\$18,894		\$21,377	\$40,271
Nevada Sales Tax	3.75%	%		•		\$802	\$802
Subtotal							\$41,073
Contractor OH & Profit	25.0%	%					\$10,268
Subtotal							\$51,341
Bond	1.5%	%					\$770
Subtotal							\$52,111
Estimating Contingency	10.0%	%					\$5,211
Total Probable Construction	Cost						\$57,322

Building Number Description	<u>Simplex</u>	Duplex
117-1 Services & Supply	2	-
117-2 Central Heating Plant	-	-
117-3 Decontamination of Small Parts	2	-
117-4 Bulk Explosives Disposal	2	-
117-5 Refining Building	•	1
117-6 Steamout Building	4	-
117-6A Water Booster Pump Building	-	-
117-7 Process Water Treatment Building	-	-
117-8 Mechanical Removal Building	2	-
117-10 Preparation Building	2	-
117-11 Accumulator Building	-	-
117-15 Flashing Chamber	-	-
Totals	14	1

Reduce Central Boiler Plant Steam Pressure & Install Properly-Sized Deaerator (Including Distribution System Leak Repairs)

Deaerating Feedwater Heater

The deaerating feed water heater now in use is sized for the three large coal fired boilers. Sodium sulfite is added to scavenge oxygen from boiler feed water.

168	Lbs Na ₂ SO ₃ was added to boiler makeup water during the period:								
1-Feb-94	through	1-Sep-94	212 days, with	6,645	gallons average makeup / day;				
1,408,719	gallons to	tal in above pe	riod, or 9.1	ppm by w	eight SO ₃ overall.				

A residual of 20 ppm SO₃, as stated in the DZB letter of 5 October 1994, even without any dissolved O₂ needs 371 Lbs Na₂SO₃ during the period.

Other water treatment chemicals used for the boiler feedwater treatment during this period include:

22.65	Gallons Phosphorus
20.50	Gallons Lye
94.50	Gallons Polymer

Raw water common ion analyses indicate hardness of 152 ppm (analysis of building 117-1 cold water on 12 March 1992).

In addition, the existing deaerating feedwater heater is far oversized for the packaged boiler:

The packaged boiler can generate about 13,400 PPH of steam.

The deaerating feedwater heater is sized for 100,000 PPH of throughput.

Based on sizing alone, the package steam boiler can service either the deaerating feedwater heater or the steam load, but not both.

Conclusion: Chemicals usage for oxygen control in the boiler feed water (BFW) is insufficient.

Chemicals usage for softening BFW is insufficient.

Once through system (with almost 100% make-up) requires better water treatment

Recommendation: Clean scale from boiler water side immediately. Scaling is most likely already causing operating problems and may endanger the boiler's future operation.

Reduce Operating Steam Pressure

The operating steam pressure is higher than is needed. Building steam usage is for HVAC and WADF process use. The HVAC utilization pressure is about 40 psig; WADF processes require only 15 psig steam. Reduce the steam pressure to the minimum required to serve these requirements.

During field investigations, the steam pressure at Building 117-8, the building farthest from the central steam plant, was observed to be about 80 psig (based on existing pressure gauge). Assuming that this pressure is accurate, the system provides for about 25 psig of pressure drop from the steam plant to the farthest point of use.

	Operat	Reduced System					
Operating Period	Months	HVAC	Process	Maximum	Operating Pressure		
Winter Heating Season	Oct - May	38 psig	15 psig	38 psig	63 psig		
Summer Non-heating Season	Jun - Sep	NA	15 psig	15 psig	40 psig		

Energy savings calculations due to reduced operating pressures are based on the following:

	Total enthalpy	h _{f-g}	
Saturated steam, 105 psig =	1,190	BTU/Lb	878
Saturated steam, 63 psig =	1,183	BTU/Lb	902
Saturated Steam, 40 psig =	1,176	BTU/Lb	920
Liquid, 200°F =	168	BTU/Lb	
Liquid, 50°F =	18	BTU/Lb	

Existing Energy Consumption, including: Recommended HVAC Control, Exhaust Heat Recovery and Air Curtain Retrofits and Repairs to HVAC Steam Condensate Return Systems

Steam Plant Efficiency (Baseline):	Jonuensale	55.0%
HVAC System Requirements		
HVAC Steam LOAD, with HVAC ECOs Implemented:	3,712	Million BTU/Year
Steam Needed at 40 psig to satisfy load:	4,034,585	Pounds Steam/Year
Heat required from boiler with condensate system repaired, 105 psig:	4,123	Million BTU/Year
Process Steam Requirements	·	
Steam requirements based on Make-up Water Records:	20,705	Lbs/Process-Day
Process Days per Year assuming Sundays-only off:	313	Process-Days/Year
Process Steam Requirements:	6,480,509	Pounds/Year
Heat required at present operating steam pressure (105 psig):	7,595	Million BTU/Year
Steam Leaks in Distribution System	•	
Steam Loss due to leaks in distribution piping:	34,247	Pounds/Day
Days per year of boiler operations (including non-processing days)	365	Days/Year
Steam Losses:	12,500,129	Pounds/Year
Heat required at present operating steam pressure (105 psig):	14,650	Million BTU/Year
Total Steam Heat Required	26,369	Million BTU/Year
Equivalent No. 2 Fuel Oil Consumption (corrected for leakage):	37,941	Million BTU/Year

Future Energy Consumption, including: Repairs of Steam Distribution System Leaks, Installation of a Proper-Sized Deaerating Feedwater Heater

& Operations at Reduced Steam Pressures

Steam Plant Efficiency with leaks repaired (see Efficiency Calculation	ıs):	64.5%
HVAC System Requirements		· · · · · · · · · · · · · · · · · · ·
HVAC Steam LOAD, with HVAC ECOs Implemented:	3,712	Million BTU/Year
Steam Needed at 40 psig to satisfy load:	4.034.585	Pounds Steam/Year
Heat required from boiler with condensate system repaired, 63 psig:	4,095	Million BTU/Year
Process Steam Requirements	.,	
Steam requirements based on Make-up Water Records:	20,705	Lbs/Process-Day
Process Days per Year assuming Sundays-only off:	313	Process-Days/Year
Process Steam Requirements:	6,480,509	Pounds/Year
Heat required at reduced operating pressure (63 psig - Winter):	3,775	Million BTU/Year
Heat required at reduced operating pressure (40 psig - Summers):	3,752	Million BTU/Year
Total Heat required at reduced operating pressures:	7,527	Million BTU/Year
Steam Leaks in Distribution System	•	
Steam Loss due to leaks in distribution piping (assumed repaired):	0	Million BTU/Year
Total Steam Heat Required	11,622	Million BTU/Year
Equivalent No. 2 Fuel Oil Consumption (corrected for leakage):	16,723	Million BTU/Year

No. 2 Fuel Oil Savings from repairs of leaks, new deaerator and 21,218 Million BTU/Year reduced steam operating pressures:

Note: Fuel oil consumption estimated for these repairs and system upgrades is based on operation of WADF facilities two shifts per day, six days per week, year-round. This is the current schedule (Fall 1994), however, it is subject to change depending on the level of activity required.

Life Cycle Cost Analysis Summary Energy Conservation Investment Program (ECIP)

Location: Hawthorne Army Ammunition Plant Region No. 4 Project No. Western Area Demilitarization Facility (WADF), Nevada **ECIP Facility Energy Improvements** Project Title: Fiscal Year FY97 Reduce Steam Pressure, Install New Deaerator, and Repair Steam Leaks Analysis Date: November 1994 Economic Life: 15 Years Preparer: KELLER & GANNON 1. Investment Costs A. Construction Costs \$180,914 B. SIOH 10,855 C. Design Cost 10,855 D. Total Cost (1A + 1B + 1C) \$ 202,624 E. Salvage Value of Existing Equipment \$0 F. Public Utility Company Rebate \$0 G. Total Investment (1D-1E-1F) \$202,624 2. Energy Savings (+)/Cost(-): Date of NISTIR 85-3273 Used for Discount Factors: October 1994 Energy Annual \$ Cost Saving Discount Discounted Source \$/MBTU(1) MBTU/Yr(2) Savings(3) Factor(4) Savings(5) A. Elec. \$12.82 0.0 \$0 12.02 \$0 B. Dist \$6.13 21,218 \$130,030 14.23 \$1,850,332 C. LPG D. Other E. Elec Demand \$102.21 F. Total 21,218 \$130,030 \$1,850,332 3. Non Energy Savings (+) or Cost (-): A. Annual Recurring (+/-) (\$2,714) (1) Discount Factor (Table A) 11.94 (2) Discounted Savings/Cost (3A x 3A1) (\$32,402)B. Non Recurring Savings (+) or Cost (-) Item Savings(+) Year of Discount Discounted Cost(-)(1) Occur. (2) Factor(3) Savings(+) Cost(-) (4) (\$57,961) 5 a. 0.863 (\$50,020) b. (\$57,961) 10 0.744 (\$43,123)C. 15 (\$57,961) 0.642 (\$37,211) d. Total (\$173,882)(\$130,354) C Total Non Energy Discounted Savings (3A2+3Bd4) (\$162,755)4. First Year Dollar Savings (2F3+3A+(3Bd1/Years Economic Life)): \$115,725 5. Simple Payback (1G/4): 1.75 Years 6. Total Net Discounted Savings (2F5+3C): \$1,687,577

8.33

7. Savings to Investment Ratio (SIR) 6/1G:

					Date Prepared Sheet			
CONSTRUCTION CO	November-94 1 1							
Project ECIP Facility Energy Imp	Project No.	Basis for Es	timate					
Location Western Area Demi	NDE)	-						
Hawthorne Army Amr								
Engineer-Architect	na na	iii iaiit	, Nevaua	l	Code A (no	design comp	eted)	
Keller & Gannon								
Drawing No. Steam Leak Repairs,	New	Estimator			Checked By			
Deaerator & Lower Steam Pre	ssures		B. I. Ho	rst	Jones By	R. C. Le	nnia	
	1	ıantity	T	abor	-		T	
Line Item	No.	Unit		abor		aterial	4	
			Per	_	Per		Total	
Deaerating Feedwater Heater Retro	Units	Meas.	Unit	Total	Unit	Total	Cost	
Deaerating Feedwater Heater for	71 L	T		1	<u></u>	1		
Cleaver Brooks Steam Boiler	1	EA	\$15,000	\$15,000	\$35,000	\$35,000	\$50,000	
Pipe - Deaerating Feedwater Heater:			<u> </u>		,,	700,000	Ψ30,000	
4-inch Dia Sch 80 Welded Steel	250	LF	\$16.51	\$4,127	\$10.10	\$2,526	\$6,653	
Pipe - Deaerating Feedwater Heater:	ļ				V	42,020	Ψυ,υυο	
2-inch Dia Sch 80 Welded Steel	100	LF	\$10.01	\$1,001	\$4.49	\$449	\$1,450	
Steam Pressure Controller & Interfa	1	L		.,	Ţ .	V 110	Ψ1,430	
Steam Pressure Sensor	1	Ι ΓΑ	607	407	4000			
P/E Relay	1	EA EA	\$67	\$67	\$873	\$873	\$940	
Auxilliary Contact	1	EA	\$55	\$55	\$130	\$130	\$185	
DDC Control Unit - 16 Point			\$50	\$50	\$350	\$350	\$700	
	1 1	EA	\$500	\$500	\$2,500	\$2,500	\$3,000	
Miscellaneous Steam Distribution P	iping Le	ак Кера	airs					
Steam Main 14-inch "Spool" on 10- inch line, replace flange & gaskets	1	EA	\$271	\$271	\$150	\$150	\$421	
Steam Control Valve, 4-inch Flanged, Iron Body	2	EA	\$122	\$122	\$1,577	\$3,154	\$3,276	
Replace Ball-Expansion Joints, Steam Piping, 10-inch Steam	10	EA	\$125	\$1,254	\$1,871	\$18,711	\$19,965	
Replace Ball-Expansion Joints, Steam Piping, 6-inch	10	EΑ	\$79	\$790	\$1,096	\$10,959	\$11,749	
Labor and Materials for steam piping miscellaneous repairs	500	МН	\$42.33	\$21,165	\$14.11	\$7,055	\$28,220	
Subtotal				\$44,402		\$81,857		
Nevada Sales Tax	3.75%	%		- ΨΤΨ,ΨΟ <u>Σ</u>			\$126,560	
Subtotal	20,3					\$3,070	\$3,070	
Contractor OH & Profit	25.0%	%				-	\$129,629	
Subtotal	20.070						\$32,407	
Bond	1 50/	9/					\$162,037	
Subtotal	1.5%	%					\$2,431	
	10 -						\$164,467	
Estimating Contingency	10.0%	%					\$16,447	
Total Probable Construction	Cost						\$180,914	

For Life Cycle Cost Analysis, assume steam piping leak repairs must be performed every five years. These costs are expensed each five years in the Life Cycle Cost Analysis Summary. \$57,961

Annual O&M expenses are assumed equal to 1.5% of the construction costs per year: \$2,714 per year.

Install Oxygen Trim Combustion Controls <u>and</u> Boiler Flue Economizer on Fire-Tube Boiler to Preheat Boiler Feedwater

Based on field measurement of combustion efficiency and on conversations with the boiler representative (R.F. McDonnald), the existing Cleaver-Brooks Fire-Tube Steam Boiler is not properly trimmed.

The high oxygen content in the flue gasses results in wasteful operation and a low stack temperature. The boiler burner should be retrimmed to about 7% oxygen (rather than the measured 11.65% oxygen) at low fire. Such retrimming will increase the existing stack temperature from 375°F to about 440°F.

The combustion efficiency will be improved from the current 78.0% to about 79.9% which is about a 1.9% improvement. Increasing the steam plant efficiency to 71.4% overall, from an efficiency of about 69.5% assumed after implementation of the energy conservation opportunities involving repairing leaks, reducing steam pressure and installing a properly sized deaerator.

Installation of a stack economizer to recover additional heat to preheat cold makeup water will improve the steam system efficiency an additional 6.7% according to the manufacturer's representative, based on a computer simulation at the low firing rate. The improved steam plant efficiency will, thus be about 78.1%.

Fuel Oil Consumption after leak repairs, new

deaerator and steam pressure reduction:

Revised Annual Fuel Oil Consumption is thus:

16,723 Million BTU/Year

15,288 Million BTU/Year

Fuel Oil Savings from Economizer & Oxygen Trim:

1,435 Million BTU/Year

The circulation pump used for heat recovery will be operated continuously. Based on the manufacturer's system sizing calculations, the flue economizer is sized for a 36 gpm flow rate, with as high as a 4.2 ft head loss. Assuming a 60% efficient circulation pump, about a 1/2 HP motor is required. Electrical requirements are: 8,009 kWH/Year, or 27.3 Million BTU/Year equivalent

This corresponds to 0.91 kW additional electric demand.

Operation and Maintenance

Annual O&M expenses are assumed equal to 1.5% of the construction costs per year for replacing worn components, plus 40 manhours per year for periodic adjustments and calibrations.

Assuming a plumbers rate from Means '94, location adjusted, the annual O&M expenses are estimated at: \$2,490 per year.

Life Cycle Cost Analysis Summary Energy Conservation Investment Program (ECIP)

Location:		ny Ammunition Pla	Project No.					
Project Title:		Demilitarization Fac						
r reject ritie.	ECIP Facility Energy Improvements Fiscal Year FY97 Install Flue Economizer and Oxygen Trim Combustion Controls							
Analysis Date:	November 199	4 Economic Life:	15 Yea	rs		LER & GANNON		
1. Investment	Costs							
A. Construction				\$53,821				
B. SIOH			\$	3,229				
C. Design Cost			\$	3,229				
D. Total Cost (1A + 1B + 1C)		<u> </u>	60,280				
	e of Existing Eq	uipment	•	00,200	\$0			
	Company Reba				\$0			
-	ment (1D-1E-1F)					 \$60,280		
2 Engrav Sovin	200 / 1 VC+/ V					400,200		
2. Energy Savin		f D' F .						
Date of MISTIR	85-32/3 Used	for Discount Facto	ors: Oct	ober 1994				
Energy	Cost	Saving	۸	nnual \$	D '	5.		
Source	\$/MBTU(1)	MBTU/Yr(2)		vings(3)	Discount	Discounted		
	,,,,,,	111070/11(2)	Sa	virigs(3)	Factor(4)	Savings(5)		
A. Elec.	\$12.82	(27.3)	(:	\$350)	12.02	(\$4,212)		
B. Dist	\$6.13	1,435		3,792	14.23	\$125,105		
C. LPG	•	-		,,,,,,		V125,105		
D. Other	-					•		
E. Elec Demand	\$102.21	(0.9) k	:W {	\$93)	12.02	(\$1,123)		
F. Total		1,407		3,348		\$119,770		
3. Non Energy S	Savings (+) or C	Cost (-):						
A. Annual Recui			(\$2	2,501)				
(1) Discount Fac					11.94			
(2) Discounted S	Savings/Cost (3/	A x 3A1)				(\$29,856)		
P. Non Dogweis	- C 1 1-1							
B. Non Recurring	g Savings (+) o	r Cost (-)						
Item	Savings(+)	Vacuat	D:					
TC.	Cost(-)(1)	Year of	Disco		Discounted			
a.	COSt(-)(1)	Occur. (2)	Facto	r(3)	Savings(+) C	ost(-) (4)		
b.		-						
C.								
d. Total	\$ 0		-					
J. 10ta	40				\$ 0			
C Total Non Ene	rgy Discounted	Savings (3A2+3B	3d4)		(\$29,856)			
4. First Year Dol	lar Savinos (2F3	+3A+(3Bd1/Yea	rs Econ	nmic Lifelli	\$5,847			
5. Simple Payba	ck (1G/4):	,324.,700	5	Elie//.	10.31	Years		
6. Total Net Disc		(2F5 + 3C):	•		\$89,914	1 5015		
7. Savings to Inv					1.49			

	Date Prepared		Sheet	of			
CONSTRUCTION CO	Novem	ber-94	1	1			
Project	Project No.	Basis for Est	imate				
ECIP Facility Energy Impl		1					
Location Western Area Demili	ADF)						
Hawthorne Army Amm	unition	Plant,	Nevada		Code A (no	design compe	ted)
Engineer-Architect].		
Keller & Gannon							
Drawing No. Retrofit Flue Economiz	zer	Estimator			Checked By		
& Oxygen Trim Combustion Co			B. I. Ho	orst	,	R. C. Ler	nia
	T	antity	T	Labor	M:	aterial	<u>g</u>
Line Item	No.	Unit	Per	Luboi	Per	lena	Total
	Units	Meas.	Unit	Total	Unit	Total	Cost
Oxygen Trim Combustion Control						1 10(0)	1 0030
Oxygen Trim Combustion Control	1	EA	\$1,500		Ĭ	£45.000	\$46 F00
Retrofit Package		EA	\$1,500	\$1,500	\$15,000	\$15,000	\$16,500
Flue Economizer Heat Recovery Pa	ckage	,					
Thermostack Waste Heat Reclaim	1	EA	\$2,000	\$2,000	\$9,000	\$9,000	\$11,000
Unit, Model TS-130 Oper Unit Package, including Pump,				,, -		, , , , , , , , , , , , , , , , , , , ,	,
T&P Relief, Valves, Thermostat, etc.	1	EA	\$237	\$237	\$556	\$556	\$793
Steel Pipe, 1-1/2", Schedule 80					4		
including 10% allowance for fittings	200	LF	\$13.26	\$2,651	\$3.96	\$791	\$3,442
Fiberglass Insulation, 1-1/2" Wall, 1-	200	LF	\$4.59	\$917	\$1.64	\$327	\$1,244
1/2" Pipe, All Service Jacket	200	L1	Ψ4.59	4517	\$1.04	φ32 <i>1</i>	\$1,244
Aluminum Jacket, 0.016"	196	SF	\$5.10	\$1,001	\$0.56	\$110	\$1,111
		<u> </u>		•			
Circulating Pump: 1/2 HP	2	EA	\$152	\$305	\$1,181	\$2,362	\$2,667
Wiring & Conduit	80	LF	\$5.16	\$412	\$1.90	\$152	\$564
Motor Starter (Mechanical Room)	1	EA	\$83	\$83	\$94	\$94	\$177
Subtotal				\$9,107		\$28,392	\$37,500
Nevada Sales Tax	3.75%	%		-		\$1,065	\$1,065
Subtotal							\$38,564
Contractor OH & Profit	25.0%	%					\$9,641
Subtotal							\$48,205
Bond	1.5%	%					\$723
Subtotal							\$48,929
Estimating Contingency	10.0%	%					\$4,893
Total Probable Construction	Cost						\$53,821

FACSIMILE TRANSMITTAL SHEET
R. F. MacDONALD CO.
Forther City, CA 04404
(415) 574-0110 - FAX (415) 574-1007 PROJECT No. production in the product of the
DIM 1
TO: Keller & Gannen DATE: 12016/99 (M/C)
ATTN: Blair Hohat FROM: ROBERT F. MacDONALD
REF: army ammunition FAX: 864-3681
Plant Hawthorne, Meusda
- Modifications to existing attan Clant
Existing briler - Cleaver Firster
Model CB 100-400-150 + Steam,
Unit # L 89956 - 400 HP, #2 oil fined
Budget prises for:
Glonomizer-Thekmontale
Madel 138 75-130 490000
Bleaven Brushed On Thim
systems 15,000
Packaged Description of
5M15PW/ 2 boiler do and Relando 352no
July existing BF Bunker
- Can be well delivet, 4 (0000 (for 2)
TOTAL NUMBER OF PAGES 7 (INCLUDING COVER SHEET)

ThermaStak

Specifications and Technical

Data

Listings and Patent

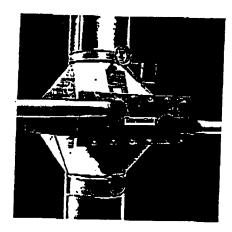
- A.G.A. Design Certified
- U.L. Listed
- ASME "U" Stamp—Optional
- U.S. Patent Number 4,215,741





ASME STAMP AVAILABLE





Heat Exchanger

Tubing

% O.D., 0.035" wall seamless copper tube SB-111-80 alloy 122. (Limited to 900°F exhaust temp.).

Headers

Seamless copper tubing type L ASTM B-88 alloy C12200 1" nominal—1 1/4" O.D., 0.05" wall thickness 11/2" nominal—1 1/4" O.D., 0.06" wall thickness 2" nominal—21/4" O.D., 0.07" wall thickness

Connections

NPT fittings in accordance with ANSI B 16.22

Fins

0.0085" thick, copper CDA 110, ASTM B 152 Tube holes extruded and flared for positive fin spacing. 1½" triangular staggered fin pattern Coatings (Available Upon Request) Electroless nickel coating for corrosion resistance. (Limited to 1100°F exhaust temp.).

Heresite coating, (Limited to 425°F exhaust temp.).

Housings

Standard (TS-010-080) 22 gauge, AISI type 304 2B stainless steel. Heavy (TS-100-150) 18 gauge, AISI type 304 2B stainless steel or 0.1345 10 gauge, cold rolled steel, AISI 1008 or 1010.

R=98%

12-06-94 03:19PM P002 #31

Dimensions/Operating Specifications

	Madel No.	Flue Diameter (Inches)	Height	Overall Ofmension: (Nuches) Width	s Length	Barometric Vaii Heights	Water Connections (Suctions)	Fin.	low Rate (GPM) Max.	Heat Transfer Acea [F17]	Water Capacity (Gal.)	Shipping . Weight
a de la companya de	TS-010+	6	20.5	12.5	16.5	28.2	1	5	10	9.4	0.2	(Lbs.) 64
	TS-015+	8	25.5	15.5	19.5	30.0	1	6	12	21.9	0.3	76
1	TS-018	10	20.5	15.5	19.5	29.5	1.5	6	14	21.9	0.4	87
One	TS-020+	10	25.5	18.5	22.5	33.0	1.5	8	18	34.2	0.5	90
Row	TS-0M1+	12	25.5	21.5	25.5	34.0	1.5	9	21	49.3	0.5	
Voits	TS-0M2+	16	26.5	27.5	31.5	39.5	1.5	12	28	43.3 87. 8	0.7	120
ı	TS-OM3+	20	3 2.5	33.5	37.5	45.0	1,5	15	30	137.2	1.0	200
	TS-048+	24	29.0	39.5	43.5	51.5	1.5	18	30*	197.6	1.3	240
L	TS-080+	28	28.5	45.5	50.0	50,5	2.0	21	49	268.8	1.8	410
										200.0	1.0	410
	TS-025	8	25.5	15.5	19.5	30.0	1.5	12	28	33.6	0.8	92
3	TS-030	10	25.5	18.5	22.5	33.0	1.5	15	30	52.4	0.9	106
Two	TS-035	12	25.5	21.5	25.5	34.0	1.5	18	30	75.4	1.1	135
Row	TS-045	16	28.5	27.5	31.5	39.5	1.5	24	30-	1344	1.5	220
Units	TS-060	20	32.5	33.5	37,5	45.0	20	30	60	210.0	2.0	272
1	TS-105	24	29.0	39.5	44.0	CF	2.0	36	60*	302.2	3.0	CF
L	TS-125	28	28.5	45.5	50.0	CF	2.0	42	60"	411.3	3.8	CF
										71110	0.0	
ł	TS-040	12	28.5	21.5	25.5	CF	1.5	9	21	113.2	1.1	153
Three	TS-055	16	31.5	27.5	31.5	CF.	1.5	12	28	201,4	1.8	222
Row	TS-110	20	35.5	33.5	38.0	CF	2.0	15	35	314.8	3.0	CF
Units	TS-130 -	- 24	32.0	39.5	44.0	CF .	2.0	18	42	453.4	4,0	CF CF
	TS-145	28	31.5	45.5	50.0	CF	2.0	21	49	616.9	5.2	CF CF
						_						
	TS-050	12	28.5	21.5	25.5	CF	1.5	18	30"	150.9	1.5	173
Four ·	TS-100	16	31.5	27.5	32.0	CF CF	20	24	56	268.5	2.6	CF
Row	TS-120	20	35. 5	33.5	38.0	CF .	2.0	30	60*	434.2	3.8	CF CF
Units	TS-140	24	32.0	39.5	44.0	CF .	2.0	36	60°	604.5	5.5	CF CF
L_	TS-150	28	31.5	45.5	50.0	CF	20	42	60"	822.5	7.0	CF CF



+AGA design certified models. Acceptable for use with almospheric burners.

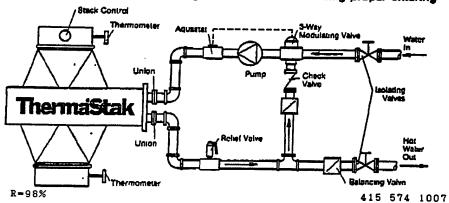
Standard package includes: Two stack thermometers Automatic thermastat pump control Temperature/pressure relief valve Balancing valve 22 gauge stainless casing (10-80) 10 gauge carbon steel casing (100-150) Copper coil and fins Instruction booklet

Cold Entering Water Conditions

The inlet water to the ThermaStak Waste Heat Reclamation System must be maintained at certain minimum temperatures to prevent cold end corrosion on the heat exchanger

surface. These minimum temperatures are 105°F for natural gas and 160°F for No. 2 fuel oil. The piping schematic below is the recommended method of assuring proper entering

water temperatures. Please consult the factory for 3-way valve specifications.



Aquastat should be set so that:

- 1. For natural gas the entering water is 105°F or more.
- 2. For No. 2 fuel oil the entering water is 160°F or more.
- 1. Minimum aquastat dead band 20°F.



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Reliable O₂ Trim Systems Are Offered by Many... But Delivered by Cleaver-Brooks

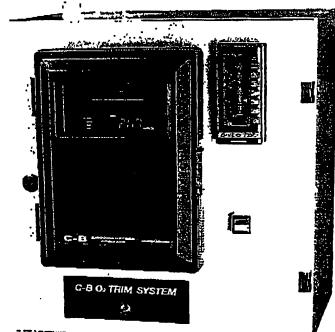
C-B O₂ TRIM SYSTEM

Cleaver-Brooks offers the C-B O₂ Trim System — a complete package to control and maintain optimum fuel-to-air ratio and maximum fuel efficiency.

The System's proven dependability has been accorded in thousands of installations worldwide. With advanced technology and outstanding features, the C-B O₂ Trim System delivers reliable monitoring and exceptional control of O₂ concentrations.

The C-B O₂ Trim System is designed to be easily maintained on site.

Money-Saving
Feature: The new O₂
Trim System — on a
typical application —
can save up to 2% in
annual fuel cost due to
reater efficiency. This
is accomplished by
adjusting either the air
or gas levels to achieve
optimum firing.



ANALYZER

The C-B Zirconia Oxygen Analyzer uses a direct in situ method of analyzing flue gas; making it the fastest reacting, most accurate, and reliable method available. The large LED display continuously informs the operator of the current O2 level and other flue gas information. An optional stack temperature transmitter enables the analyzer to compute and display combustion efficiency.

Money-Saving

Feature: The analyzer diagnostics predict the remaining cell life of the Zirconia Cell. The cell can be serviced on-site while the boiler is in use, not interrupting boiler system uptime.

PROBE

The probe is the basic component of the analyzer. The C-B Probe has undergone refinements and improvements based on years of experience

and wide-ranging application. Its superior stability and reliability will provide years of trouble-free performance.

Features:

- Easily replaced longlasting cell
- Built-in reference iunction
- Fast response
- Heavy-duty heater and thermocouple
- No aspiration required

CONTROLLER

The microprocessorbased controller indicates the percentage of O₂ at set point and output in both digital and bar graph formats. Operation and system adjustments are made from a menu on the front panel display. The display also includes graphs for viewing trend logs.



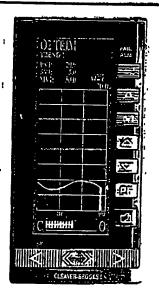
R-98%

415 574 1007

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Analyzer with self diagnostics and large easy-to-read display of calibrated information.



Controller

indicates oxygen set point curve as well as O2 trend.

C-B O TRIM SPECIFICATION

PROBE

Weight

Sample Gas Temperature: Insertion length:

0 to 1100°F. 15.75, 27

Ambient Temperature:

14 to 176°F. Material in contact with gas: Stainless Steel, Zirconia

Installation: Endosure:

Figure mounting (equivalent to 2" 150 lbs FF ANSI flange)

NEMA 4

Insertion length 15.75" appr. 9 lbs

Insertion length 27"

appr. 12 lbs

CONTROL PANEL

Power Supply: Dimensions:

110/120 VAC, 3 Amps. 50/60 Hz

20" H x 20" W x 13" D

Weight: Ambient Temperature:

Appr. 70 lbs 32 to 122°F.

25-125 psig instrument air dry, oil free

Outputs:

Air Supply:

Control: Recorder:

Contact:

Indication:

3-15 psig

Q, value 1-5 VDC or 4-20 mA DC

Firing Rate 1-5 VDC 250 VAC 2 Amos

Low O₂ alarm

Low O, shutdown

Oxygen level 0.0 to 100 Vol %

Set point 0-14% O Control output 0-100% Fuel selection

Calibration:

Other features:

Options:

Automatic one point

Manual two point

10-segment set point curves for oil and gas

Local or remote fuel selection

Oxygen cell life span prediction/Self diagnostics Variable response at different firing rates

integral only response on set point change

Trim fuel or air

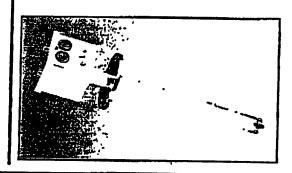
Eight preset responses to simplify tuning

Oxygen trend display

Flue gas temperature efficiency indication

Stand

Stack Probe Adapters

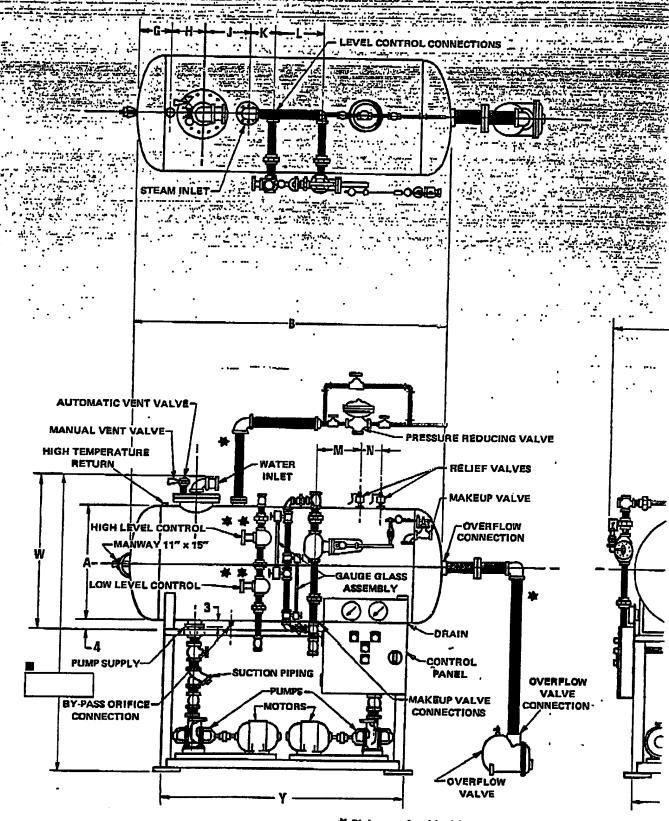


Zirconia Probe with easily interchangeable cell. It is available with special stack adapter kit and/or extended length.

Authorized Sales, Service, and Parts Worldwide



Division of Aqua-Chem, Inc. P.O. Box 421 Milwaukee, WI 53201 (414) 359-0600



Piping not furnished (control shipped loose).

★ Mot furnished unless specified.

Dimensions and Layout Data

Ē,		Part Medical Street Street					A Park Company		
	-70	Spraymaster Model No. 27	SMIS-P	1 SM30-P.	SM45.P	JENTO D			
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12	**	Rating (lbs:/hr:)	-15,000 -7	1.30,000	45,000	CA2 VAD K	ATINGS ====		
 -	뜻	"I ank Capacity "" 1	300			.⁴.≥70,000	100,000	140,000	
7	=:	(gallons to overflow)	300	600	900	1,400	2,000	2,800	
<u></u>	Ž	I gnk Diameter	. 48	54	60				
	В	Tank Length	T-8'0"-(3	10'0"	3111111	14'10'		7 .0 84	
3		-Total Height - Charget	بي سين سين.	": Varies	with an last			*15'4"	
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-	<u>H.</u>	The state of the s	- in 18	182	7. 17%	M:18% "	194-	-21½ 	
١.	إناب	والمستخرج والمستخرج المستخرج المستخرج	7:520 .35	30		**************************************	T-224 5	TT22 % T	
7	K	or mismall moder a specie in wealth	7124 3	12	12	3 20 Tel		יהי24 דתיחי	
<u>ځ. ا</u>	L	TO BELLEVAN TO THE STATE	1.70751/	100 6	13	1 14 : +2	7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7	·~÷13½·~·	
	M		6	. 15	271/4 T	~ 24 %	36	× (25¼ つF	
٠L	N			6	7	. 38 ~.	40	1.36	
: Г	VΤ	Total Width	5'6''		8 .	1 11	11 2	. 9	
. [10101 1110111	3.0	6'0"	6'6'' .	7'0" "	7'6" .	8'6"	
٦.	W 5141			514" Select correct stand height					
	X		5'4"	6'4',"	6'9"	7'3"	7'112''.	-9'1" ;	
٠H	? +		60 .	60	72 .	74	. 70 :-	94	
: -	┯		75 %	94	"102 ×	145 4	163 %		
L			TANK CONNECTION SIZES						
High Temperature Return 1% .2				AV COMILE		:>			
L		Level Control	12	1/2	-4.	3	3	.∙3	
L		Steam Inlet			1 1/2	14	14	. 14	
		Makeup Valve	7 7	to" Fla.	16" Fla.	16" Fla.	16" Flg.	18"%Flg.	
	L	Relief Valve	2 0 2"	202"	302"	2	. 2	2	
<u> </u>		Pump Supply	3	7		3 @ 3"	3@3"	3 @ 3"	
L		Drain	<u> </u>	- 3- 1 -	†4" Flg.	†4" Flg.	†4" Flg.	t4" Fig.	
₽		Overflow	3	3	- 3	140 6	2 .	2	
ᆫ		Thermometer	*	3		14" Fig.	†4" Flg.	†4" Flg.	
匚		By-Pass Orifice	1 -		- *	- 4	*	*/4	
L	T		14" Fig. 1	2" Flg.	77" E1.	2000			
				- 1 19.	<u> </u>	124" Fig.	t3" Fla.	14" Fla.	

ALL DIMENSIONS IN INCHES UNLESS OTHERWISE NOTED

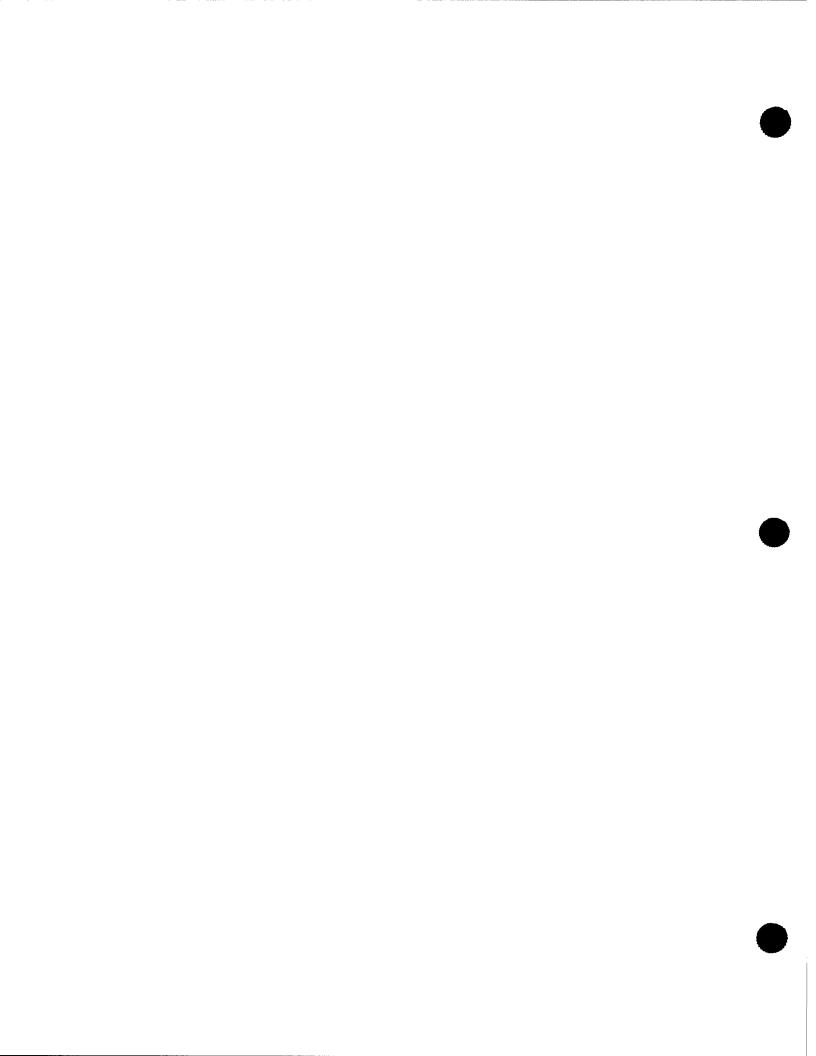
- FOR EACH PUMP
- † 150 LB. ASA FLANGE

GENERAL NOTES:

- 1. Customer to plug all fittings not used.
- Mount tank above pump at elevation necessary for static head including safe allowance for piping friction as approved by pump manufacturer.
- 3. Tanks built to ASME Code includes 1/16" corrosion allowance.
- 4. Head and shell thickness based on 50 P.S.I. design pressure.
- Accompanying dimensions, while sufficiently accurate for layout purposes, must be confirmed for construction by certified prints.

EEAP Energy Survey of Army Industrial Facilities Western Area Demilitarization Facility, HWAAP, Nevada **APPENDIX F Process Heat Recovery and Insulation Repair Retrofit Calculations** F:\PROJ\1640316\WORD\ARMY_IND.SRV 941209

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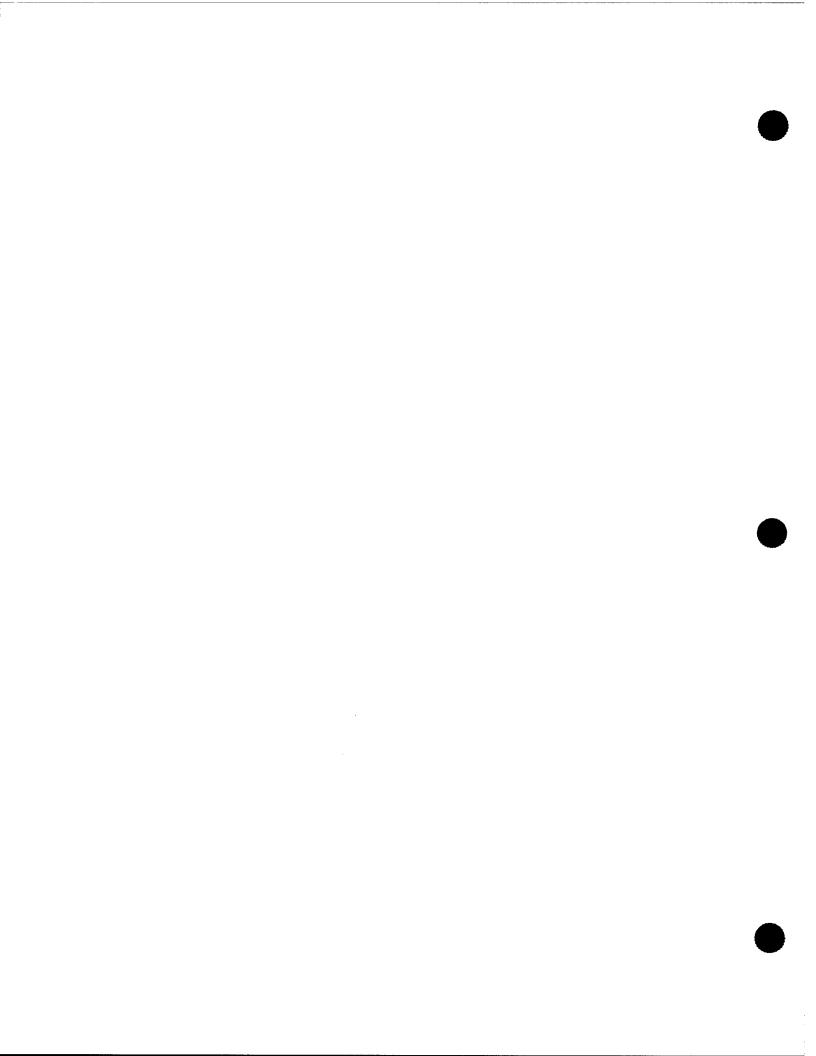


EEAP Energy Survey of Army Industrial Facilities Western Area Demilitarization Facility, HWAAP, Nevada

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Table F-1. Summary of Process Heat Recovery Retrofit Evaluations F-1
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Heat Recovery from Processing in Building 117-15
Buildings 117-5 and 117-6 Melt Kettle and Separator Tank Insulation Repairs
Life Cycle Cost Analysis Summaries
Construction Cost Estimates

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EEAP Energy Survey of Army Industrial Facilities Western Area Demilitarization Facility, HWAAP, Nevada APPENDIX F **Process Heat Recovery and Insulation Repair Retrofit Calculations**

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Process Heat Recovery and Insulation Repair Retrofit Calculations

Several processes at WADF involve high temperature processing of explosive materials and munitions components. Heat recovery from these processes for space heating purposes is evaluated. These facilities include:

- Building 117-3 Small Items Decontamination Facility
 - Lead Items Rotary Furnace System (1 Each)
 - Detonating Items Rotary Furnace System (2 Each)
 - Small Items Furnace System (1 Each)
- Building 117-4 Bulk Explosives Disposal Facility
 - Bulk Explosives Slurry Incinerator System (2 Each)
- Building 117-15 Flashing Chamber
 - High temperature "burn-out" of small items contaminated by explosives

Processing buildings 117-5 and 117-6 utilize steam to assist in the removal of explosives from various munitions. Melt kettles installed in both buildings and a separation tank located in building 117-6 are semi-spherical steam-jacketed vessels. Insulation applied to the exterior of these vessels has fallen off. Insulation repairs are evaluated.

Energy saving calculations and economic analyses follow. Results are summarized on Table F-1.

Table F-1. Summary of Process Heat Recovery Retrofit Evaluations

Description	Econ Life Years	Energy \$/Year	LCC\$ Saved ¹	Investment \$	SIR	Payback Years
Process Heat Recovery for Space Heat	ating:					
Building 117-3 Furnaces	20	\$4,436	\$69,145	\$68,872	1.00	19.60
Building 117-4 Incinerators	Not e	valuated; o	concept is s	similar to 117-3	heat rec	overy
Building 117-15 Flashing Chamber	Not ted	hnically fea	asible witho	out major proce	ss modif	ications
Melt Kettle and Separation Tank Insul	ation Repairs					
Buildings 117-5 & 117-6	15	\$4,368	\$53,687	\$5,907	9.09	1.61
Note 1: LCC\$ Saved are life cycle cost sa	avings includin	g both energ	y and non-e	energy cost savin	gs. 	

Heat Recovery from Processing in Building 117-3

Each of the processes in the Small Items Decontamination Building involves exposing explosives contaminated components to high temperatures to combust any residual explosive materials and transfer to storage for metals recycling.

Heat recovery is possible from high temperature breaching between rotary furnaces and cyclone separators (the first step in the air pollution control equipment). Custom designed heat exchangers can be fabricated to remove some of the heat from the flue exteriors without intrusive modifications into process equipment. Such heat exchangers would consist of concentric flue pipe sections, flooded with heat transfer fluid. (Outer piping would be "dimple-plate" to promote turbulent flow.)

The heat recovery concept is to recover sufficient heat to displace the need for steam required for space heating purposes. Heating fluid (Dowtherm or a similar liquid) is pumped between the heat

exchanger placed on rotary furnace breaching and a heat exchanger to be placed upstream of the steam to ethylene-glycol heat exchanger in the mechanical room. The system is sized to recover 100% of the space heat needed and would displace the need for steam heating whenever the rotary furnaces are operating. Since it is unlikely that both rotary furnaces would operate simultaneously, three heat exchangers are needed, each with the capacity to recover 50% of the space heating load. The 3 heat exchangers must each be sized to recover 1,273,066 BTUH. (Refer to heating equipment list.)

Assuming a ΔT for the heat recovery fluid of 40°F, each heat exchanger must be capable of receiving flow of about 127 gpm. This flow rate requires a header of about 3-inch diameter. Individual heat transfer piping to be welded to the flue are assumed 1-inch diameter. Based on a U value of 1,000 BTU per °F-SF, approximately 32 SF of heat transfer area is required for each of the three flues.

Based on computer simulations of the building heating system, about 969,580 kBTU per year of fuel oil is required after implementation of building envelope and HVAC controls retrofits. Adjusting for boiler efficiency improvement from 55% to 71.4% (resulting from recommended steam system retrofits), the building HVAC system fuel oil requirement (as steam) is: 746,875 kBTU/Year.

The circulation pump is about 3HP; based on 16 hours per day operation for 3 months, power usage is estimated at 3,223 kWH per year.

The life cycle cost analysis for this concept results in an SIR of about 1.00 and a payback period of 19.6 years even though very generous assumptions are made for this first screening and analysis. This retrofit is not recommended due to the long payback and marginal SIR.

Heat Recovery from Processing in Building 117-4

Building 117-4, Bulk Disposal Building, houses processing equipment for incinerating a slurry of explosives in two incinerators. Sections of the incinerator (kiln) breaching could be fitted with heat exchangers similar to those proposed for building 117-3 in the above discussion. The type of installation, heat loads and expected energy recovery are expected to be proportional to those developed above, thus, heat recovery without contacting the flue gasses directly is ruled out as a viable option. Furthermore, it is unlikely that incinerator runs will be coincident with the need for space heating in the building. Thus, no further analysis of heat recovery from building 117-4 incinerators is conducted.

Heat Recovery from Processing in Building 117-15

Building 117-3, Flashing Chamber, contains a large chamber that is heated to high temperature for extended periods. The system has recently undergone an extensive modification of combustion controls and optimization by the Tennessee Valley Authority (TVA) for certification by the Environmental Protection Agency (EPA). EPA compliance testing for atmospheric emissions is currently underway (December 1994) and is expected to be successful. Presuming that the facility will be given permission to operate, the present 55-inch diameter exhaust stack is discharging about 2,000 SCFM at between 1,750°F and 1,850°F. Heat recovery is possible if it can be installed without imparting additional back-pressure to the exhaust fan systems.

The concept is to install a heat reclamation coil at the top of the exhaust stack. A static pressure regain section is required to overcome backpressure from the heat recovery coil.

Based on exhaust at: 1,800 °F and 2,000 SCFM, actual flue gas properties are: 8,692 ACFM, at 527 FPM (actual)

Based on a heat recovery coil with 0.10-inches H_2O of pressure drop; static regain section is sized: where VP is the velocity pressure in inches of H_2O ; $VP_1 = (V_1/4,007)^2 = 0.0173$ inches as H_2O In order to regain even 0.1 inch as H_2O of velocity pressure, the original flue velocity would have to be at least as high as: 1,267 FPM.

Thus, there is not enough velocity pressure originally available to allow a regain flue section to overcome the pressure drop across a coil. In order to provide any heat recovery, then, the existing fan systems serving the Flashing Chamber will have to be retuned to overcome the coil pressure drop.

The operating system at the Flashing Chamber is extremely sensitive. Based on discussions with TVA personnel who have recently modified the process for proper operation and for compliance with the EPA's atmospheric discharge requirements, a great deal of effort would be required to rebalance the system again, possibly requiring several man-months of effort of highly compensated experts.

Modifications to recover heat from the Flashing Chamber operations is, thus, not recommended.

HVAC Heating Equipment - Building 117-3

Control Room, Office & Toilets								
HC-601	1	EA	208,000	BTUH				
RA-605	1	EΑ	8,259	BTUH				
RA-606	1	EA	7,165	BTUH				
Subtotal			223,424					

Work Corridor, Cells and Storage Areas							
HC-602	1	EA	510,000	BTUH			
DH-601	2	EA	530,000	BTUH			
RA-601	1	EA	41,867	BTUH			
RA-602	3	EA	35,820	BTUH			
RA-603	1	EA	34,845	BTUH			
RA-604	2	EA	21,867	BTUH			
RA-607	1	EA	58,398	BTUH			
RA-608	1	EA	58,398	BTUH			
Subtotal			1,914,702				

Mechanic				
HC-603	1	EA	730,000	BTUH
UH-601	2	EA	63,662	BTUH
Subtotal			857.324	

Total for Building 2,995,450 BTUH

Assume 85% Diversity for Heating Equipment Load Design Load = 2,546,133 BTUH

HVAC Heating Equipment - Building 117-4

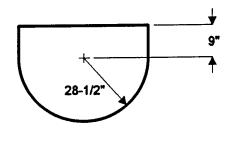
Control Room, Offices & Toilets							
HC-401	1	EA	7,600	BTUH			
RA-403	1	EA I	Electric (N/A	for this evaluation)			
RA-404	1	EA	7,500	BTUH			
RA-405	1	EA	7,500	BTUH			
Subtotal			15,000				
Work & P	roce	ssing /	<u>Areas</u>				
HC-402	1	EA	924,000	BTUH			
DH-401	1	EΑ	530,000	BTUH			
RA-401	2	EA	31,366	BTUH			
RA-402	4	EA	12,781	BTUH			
Subtotal			1,567,856				
<u>Mechanic</u>	al Ro	om					
HC-403	1	EA	319,000	BTUH			
UH-401	1	EA	33,290	BTUH			
Subtotal			352,290				

Total for Building 1,935,146 BTUH

Assume 85% Diversity for Heating Equipment Load Design Load = 1,644,874 BTUH

Buildings 117-5 & 117-6 Melt Kettle & Separation Tank Insulation Repairs

Insulation is falling off the melt kettles in buildings 117-5 and 117-6 and from the separation tank in Building 117-6. Existing insulation does not appear to be asbestos containing, and was installed in the mid-1970s, after regulations prohibiting its use were in force. These vessels are steam kettles with hemispherical bottom and cylindrical sides. Dimensions of each are shown on the diagrams below.



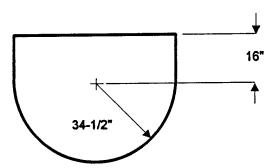
Melt Kettles, 2 Each in Buildings 117-5 & 117-6 Insulation on kettle tops is in adequate condition, insulation on the sides and bottoms is falling off.

Insulation repair area each = 46.6 SF

Total insulation repair area = 186.5 SF

Design steam load: 10 Lbs per Hour Each

Total steam load: 40 Lbs per Hour



Separation Tank, 1 in Building 117-6

Insulation on tank top is in adequate condition, insulation on the sides and bottoms is falling off.

Total insulation repair area = 76.0 SF Design steam load: 20 Lbs per Hour

Each of these vessels is fitted with a steam jacket which receives 15 psig steam. The temperature of 15 psig steam is:

250 °F; ambient temperature in the work room (towers) where the vessels are located

is about: 75 °F. The temperature difference is, thus:

175 °F

Heat losses to the air from bare and insulated surfaces at the above temperature difference:

Bare
Horizontal surface, facing downwards:Bare
2.2522" Insulation
BTUH per SF-°FΔTVertical surface:2.252BTUH per SF-°FΔT0.24BTUH per SF-°FΔT

Assume the cylindrical sides of the vessels loose heat at the "vertical surface" rate and that the hemispherical sections loose heat at the average of these two heat loss rates. Then, for bare, uninsulated, vessels, heat loss rates are:

	<u>Bare</u>		2" Insulatio	<u>n</u>
Melt Kettles:		BTUH from each Melt Kettle	1,959	BTUH from each Melt Kettle
	80,151	BTUH from 4 Melt Kettles	7,834	BTUH from 4 Melt Kettles
Separation Tank:	32,833	BTUH from the Separation Tank	3,193	BTUH from the Separation Tank
Total "Bare" Losses	112,983	BTUH Total "Insulated" Loss	11,027	BTUH

Repairing the insulation on these vessels, then, is estimated to save about 101,956 BTUH overall.

Assuming an operating schedule for the melt kettles and separation tank of 16 hours per day, 6 days per week, the annual steam load savings is estimated at: 509.0 Million BTU per year load savings.

Steam plant efficiency improvement and energy saving projects are evaluated in Appendices D and E. The steam plant efficiency after implementation of recommended projects is estimated at:

71.4%

No. 2 Fuel Oil savings based on this efficiency and the above load savings is:

713 Million BTU/Year.

Life Cycle Cost Analysis Summary Energy Conservation Investment Program (ECIP)

Location:	Hawthorne Army		=	Project No.	
Project Title:	ECIP Facility Ener		cility (WADF), Nevada		Y97
rioject ride.	· ·		s un-Around Loop on		
		-	entamination Facility	-	riues.
Analysis Date:	November 1994		-	Preparer: KELLI	ER & GANNON
1. Investment	Costs				
A. Construction	n Costs		\$61,493		
B. SIOH			\$ 3,690		
C. Design Cost	İ		\$ 3,690		
D. Total Cost (1A + 1B + 1C)		\$ 68,872		
	ue of Existing Equi	pment	•	\$ 0	
F. Public Utility	Company Rebate			\$0	_
G. Total Invest	ment (1D-1E-1F)				- \$68,872
2. Energy Savi	ngs (+)/Cost(-):				
		r Discount Facto	ors: October 1994		
Energy	Cost	Saving	Annual \$	Discount	Discounted
Source	\$/MBTU(1)	MBTU/Yr(2)	Savings(3)	Factor(4)	Savings(5)
			G		our mgo(o)
A. Elec.	\$12.82	(11)	(\$141)	15.08	(\$2,126)
B. Dist	\$6.13	747	\$4,577	18.57	\$84,997
C. LPG	-	-			-
D. Other	-				
E. Elec Demand	\$102.21		kW\$0	15.08	\$0
F. Total		736	\$4,436		\$82,870
3 Non Energy	Savings (+) or Co	et /_\·			
Of their Energy	Cavings (17 of Co	St (-7.			
A. Annual Recu	urring (+ /-)		(\$922)		
(1) Discount Fa	-		(,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	14.88	
	Savings/Cost (3A	x 3A1)			(\$13,725)
	•				(+10,720)
B. Non Recurring	ng Savings (+) or	Cost (-)			
Item	Savings(+)	Year of	Discount	Discounted	
	Cost(-)(1)	Occur. (2)	Factor(3)	Savings(+) Cos	st(-) (4)
a.	2001()() /	0	1.000	\$0	st(-) (4)
b.			1.000		
c.					
d. Total	\$O			\$0	
C Total Non En	ergy Discounted S	avings (3A2 ± 3)	Bd4)		
- Total Holl Ell	o.g, Diocounted o	avings (UMZ + O	Ju r i	(\$13,725)	
4. First Year D	ollar Savings (2F3	+ 3A + (3Bd1/Ye	ars Economic Life)):	\$3,514	
5. Simple Payb				19.60	Years
	scounted Savings			\$69,145	
7. Savings to In	nvestment Ratio (S	IR) 6/1G:		1.00	

Life Cycle Cost Analysis Summary Energy Conservation Investment Program (ECIP)

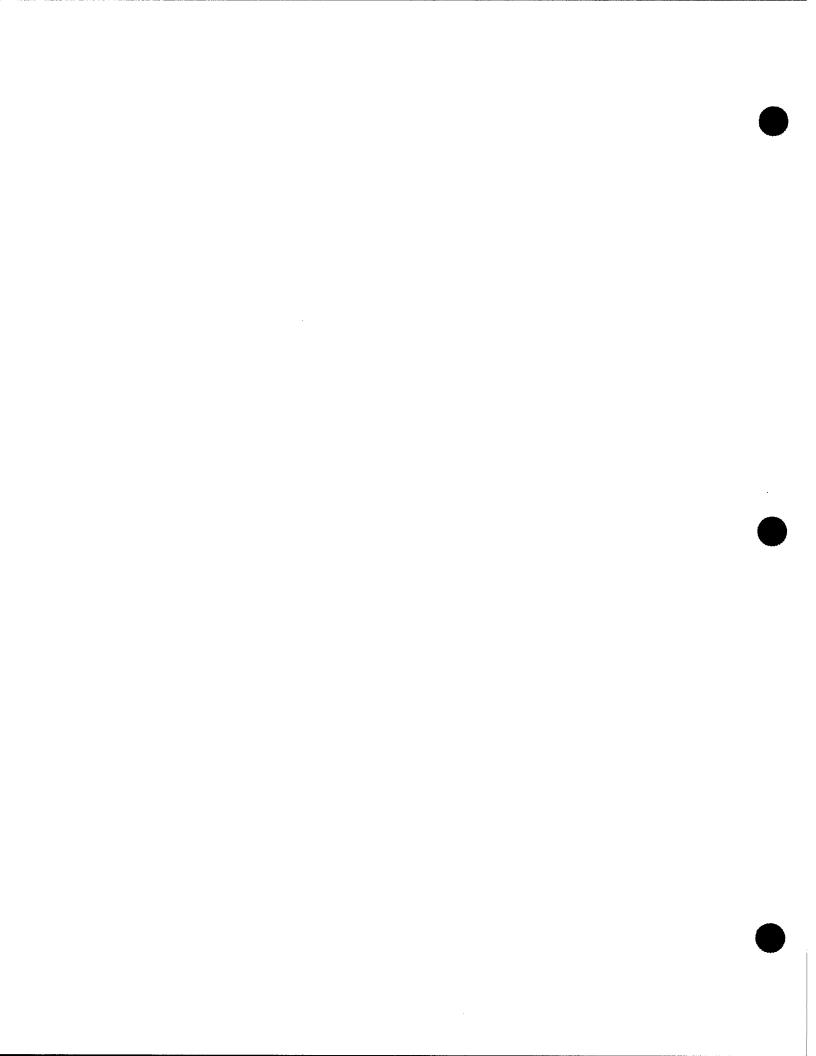
Location:			ant Region No. 4 acility (WADF), Neva	Project No. da	
Project Title:	ECIP Facility Ene	rgy Improvemer	•	Fiscal Year	FY97 nsulation
Analysis Date:	November 1994			Preparer: KELL	
1. Investment	Costs				
A. Constructio			\$5,275		
B. SIOH			\$ 316		
C. Design Cos	t		\$ 316		
D. Total Cost	(1A+1B+1C)		\$ 5,907		
E. Salvage Val	ue of Existing Equ	ipment		\$0	_
F. Public Utility	Company Rebate	•		\$0	_
G. Total Invest	tment (1D-1E-1F)				\$5,907
2. Energy Savi	ngs (+)/Cost(-):				
		or Discount Fac	tors: October 1994		
Energy	Cost	Saving	Annual \$	Discount	Discounted
Source	\$/MBTU(1)	MBTU/Yr(2)	Savings(3)	Factor(4)	Savings(5)
A. Elec.	\$12.82		\$0	12.02	\$0
B. Dist	\$6.13	712.8	\$4,368	14.23	\$62,164
C. LPG	-		•		
D. Other				10.00	**
E. Elec Deman	d \$102.21		kW \$0	12.02	\$0
F. Total		712.8	\$4,368		\$62,164
3. Non Energy	Savings (+) or C	ost (-):			
A Annual Dan	in a 1 1 1 1		60		
A. Annual Rec	actor (Table A)		<u> </u>	11.94	
* *	actor (Table A) Savings/Cost (3A	V 2A11		11.34	\$ 0
(2) Discounted	Savings/Cost (SA	X X SATI			40
B. Non Recurri	ing Savings (+) or	Cost (-)			
Item	Savings(+)	Year of	Discount	Discounted	
10111	Cost(-)(1)	Occur. (2)	Factor(3)	Savings(+) Co	ost(-) (4)
a.	(\$5,275)	5	0.863	(\$4,552)	75 (() (4)
b.	(\$5,275)	10	0.744	(\$3,924)	
c.	(40,270)			1 (10/02 1/	
d. Total	(\$10,549)			(\$8,476)	
C Total Non E	nergy Discounted	Savings (3A2+	3Bd4)	(\$8,476)	
A First V P	alles Cardana 1000) + 2A + 12D-14 A-	(oaro Eognamia 1:f-1)	. 60.665	
		+ 3A + (3D0 1/1	'ears Economic Life))		Voors
5. Simple Payl		10EE + 2C\-		1.61	Years
	iscounted Savings			\$53,687	
/. Savings to	Investment Ratio ((SIR) 6/TG:		9.09	

				Date Prepared		Sheet	of
CONSTRUCTION COST ESTIMATE					nber-94	1	1
Project				Project No.	Basis for Est	imate	
ECIP Facility Energy Impro	vemer	nts					
Location Western Area Demilit	arizatio	n Facil	ity (WAD	F)			
Hawthorne Army Amm	unition	Plant,	Nevada		Code A (no	design compe	ted)
Engineer-Architect					1 `	.	
Keller & Gannon					İ		
Drawing No. Install Process Heat	•	Estimator			0		
Recovery on Rotary Furnace F	-	Estimator	B. I. Ho	rat	Checked By	D C Lan	-1-
Recovery of Rotary Furnace P	T		T		 	R. C. Len	nig
		antity I	1	abor		aterial	1
Line Item	No.	Unit	Per		Per		Total
	Units	Meas.	Unit	Total	Unit	Total	Cost
Building 117-3 Process Heat Rec	overy	from Ro	tary Fur	naces for	Space He	ating (Sim	plified)
Insulated Flue Section with Double Wall, Flooded as a Heat Exchanger	3	EA	\$75.00	\$225	\$470.45	\$1,411	\$1,636
Pipe 3-inch Steel to Mech Room	504	LF	\$30.91	\$15,579	\$7.06	\$3,557	\$19,135
Fiberglass Insulation, 2" Wall, 3" Pipe,	504		05.70	i			
All Service Jacket	504	LF	\$5.73	\$2,889	\$2.76	\$1,390	\$4,279
Aluminum Jacket, 0.016"	924	SF	\$5.10	\$4,710	\$0.56	\$518	\$5,228
Circulating Pump: 3 HP, to 150 GPM	1	EA	\$152	\$152	\$1,181	\$1,181	\$1,333
Heat Exchanger	1	EA	\$948.12	\$948	\$9,797	\$9,797	\$10,745
Wiring & Conduit	100	LF	\$5.16	\$ 516	\$1.90	\$190	\$706
Motor Starter (Mechanical Room)	1	EA	\$145	\$145	\$171	\$171	\$316
Subtotal				\$25,163		\$18,215	\$43,378
Nevada Sales Tax	3.75%	%		-		\$683	\$683
Subtotal Contractor OLLS Profit	05.000	01					\$44,061
Contractor OH & Profit	25.0%	%					\$11,015
Subtotal	 						\$55,077
Bond	1.5%	- %					\$826
Subtotal							\$55,903
Estimating Contingency	10.0%	%					\$5,590
Total Probable Construction C	ost						\$61,493

Annual O&M expenses are assumed equal to 1.5% of the construction costs per year:
\$922 per year.

				Date Prepare	d	Sheet	of
CONSTRUCTION COST ESTIMATE				Nover	nber-94	1	1
Project				Project No.	Basis for Est	imate	
ECIP Facility Energy Impre	oveme	nts					
Location Western Area Demilit	arizatio	on Facil	lity (WAD)F)			
Hawthorne Army Amm	nunition	Plant,	Nevada		Code A (no	design compet	ed)
Engineer-Architect Keller & Gannon		•					ŕ
Drawing No. Repair Melt Kettle &		Estimator			Checked By		
Separation Tank Insulation	n		B. I. Ho	rst		R. C. Len	nig
	Qu	antity	L	abor	М	aterial	
Line Item	No.	Unit	Per		Per		Total
	Units	Meas.	Unit	Total	Unit	Total	Cost
Buildings 117-5 & 117-6 Melt H	Cettle a	nd Sep	paration	Tank Ins	ulation R	epairs	
Remove Existing Deteriorated	263	SF	\$4.11	\$1,078	\$0.00	\$0	\$1,078
Blanket Insulation from Vessels Fix Metal Insulation Tabs to Vessels.							
One per SF to Retain Insulation	263	EA	\$3.25	\$852	\$1.00	\$263	\$1,115
Blanket Type Fiberglass Insulation, 2-Inch Thick, 1-1/2 LB/SF Density	315	SF	\$4.05	\$1,276	\$0.92	\$290	\$1,566
Subtotal				\$3,206		\$552	\$3,759
Nevada Sales Tax	3.75%	%		-		\$21	\$21
Subtotal							\$3,779
Contractor OH & Profit	25.0%	%					\$945
Subtotal							\$4,724
Bond	1.5%	%					\$71
Subtotal							\$4,795
Estimating Contingency	10.0%	%					\$480
Total Probable Construction C							\$5,275

Melt Kettle and Separation Tank insulation is subject to exposure to steam throughout its useful life. The existing installation has been operating only a couple of years and has deteriorated rapidly. Assume that insulation must be replaced every 5 years. \$5,275 each 5 years.



EEAP Energy Survey of Army Industrial Facilities Western Area Demilitarization Facility, HWAAP, Nevada **APPENDIX G Lighting Data and Energy Calculations** F:\PROJ\1640316\WORD\ARMY_IND.SRV

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EEAP Energy Survey of Army Industrial Facilities Western Area Demilitarization Facility, HWAAP, Nevada

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EEAP Energy Survey of Army Industrial Facilities Western Area Demilitarization Facility, HWAAP, Nevada

LIGHTING ENERGY CALCULATION METHODOLOGY

Lighting Energy Use

Lighting energy use for buildings investigated in conjunction with this study is determined based on a combination of field observations, design data and on experience in similar projects.

Electric power usage for present and proposed fixture retrofits is determined similarly. Fixture electric loads (kW) are determined and then multiplied by the operating hours per year.

Operating hours per year are determined based on the building schedule and on the function of the room in which the fixture is located. Room and building schedules are determined by interviewing occupants. A demand/diversity factor is applied to scheduled room usage.

Lighting energy use calculations are explained in detail below; tabular summaries of calculations to determine present lighting energy use appear on Table G-1. Notations are explained on a legend as Table G-2. Room/building schedules and demand factors are provided on Table G-3 and existing lighting fixture electric demands are summarized on Table G-4.

Lighting Energy Calculations

Label	Contents / Calculation Explanation	
TASK_CODE	Room function: See legend on Table G-2.	(Field Data)
TYPE_CODE	Fixture Type: Refer to legend on Tables G-2.	(Field Data)
LAMP_TYPE	Lamp types: <u>Incandescent</u> , <u>Fluorescent</u> , <u>MV</u> Mercury Vapor Refer to Table G-2 for existing lamp/fixture t	(Catalog Data) ypes.
LAMPS/FXTR	Lamps per fixture	(Field Data)
WATTS/FXTR	Watts per fixture (Refer to Table G-4)	(Catalog Data)
NO_FXTR	Number of fixtures in room/area	(Field Data)
KW	WATTS/FXTR * NO_FXTR/1000 = Room Connected Lighting loa	ıd (kW)
HR/WK	Operating hours per week (Refer to Table G-3)	(Field Data)
DEMAND	Demand factor (Refer to Table G-3)	
KWH/Y	KW * HR/WK * 52 * DEMAND = Annual Room Lighting Power	Use (kWH/year)

Table G-1 Baseline Lighting Systems and Energy Use

Building Number	Building Name	Room No / Task Name Code		Type	Type Lamp Type Code	Watts/ Lamp	Lamp/ Fixture	Watts/ Fixture	No of Fixtures	Measured Light (FC)	Celling Height (ft)	Color	Wall	Floor	Window	Remarks	Demand	Fixture (Hr/WK)	Present Demand (KW)	Present Use (KWH/Yr)
117.1	Services & Support	98	-	œ	F40T12	64	2	8	-			٦	٦	¥	٧		9.0	8	60:0	£
117-1	Services & Support	21	6	œ	F40T12	Q	8	8	-	,	•	ب	Σ	Σ	Š	1 Zone Switch	0.	12	0.09	2
117-1	Services & Support	88	-	œ	F40T12	9	8	28	-	8	11.6	_	¥	Σ	₹	1 Zone Switch	8.0	8	0.09	35
117-1	Services & Support	88	2	œ	F40T12	\$	8	8	-	8	11.6	د	۵	_	ž	1 Zone Switch	0.7	8	80:0	301
117.1	Sewices & Support	ત્ર	8	P-ind	F40T12	\$	8	8	-		•	Σ	ب	۵	¥	1 Zone Switch	0.1	12	0.09	22
117.1	Services & Support	33	7	œ	F40T12	₽	8	8	-		•	ب	٦	_	Š	1 Zone Switch	0.7	8	0.09	8
117-1	Services & Support	æ	5	Ø	F40T12	4	8	8	•		•				•	1 Switch Zone	0.7	8	0.34	1,202
117-1	Services & Support	ಹ	7	Ø	F40T12	\$	8	8	8		•	•			•	1 Switch Zone	7.0	8	0.17	5
117-1	Services & Support	×	12	Ø	F40T12	4	8	28	8	•	•	۔	_		¥	1 Switch Zone	2.0	8	0.17	8
117-1	Services & Support	88	7	Ø	F40T12	\$	8	8	4	•	•	ب	_	ب	¥ Z	1 Switch Zone	0.7	8	0.34	1,202
117-1	Services & Support	283	8	Ø	F40T12	4	8	8	8	12	To Roof	_	Σ	۔	Š	1 Zone Switch	6.	8	0.17	828
117-1	Services & Support	Exit Signs	ā	Ø	ш	•	8	8	•	¥ Z	ž	¥	Š	ž	₹	•	1.0	89	0.18	1,572
117-1	Services & Support	Exterior		Ø	F40T12	4	7	28	8	Ē	•	۔	_	ب	Š	Photoell Control	0.7	2	0.17	751
117-1	Services & Support	Exterior	Ext	Ø	¥	175	-	1 88	4	ž	¥	ž	ž	¥	¥	Photoeil Control	0.	2	0.79	3,459
117-1	Services & Support	30, Mech	51	P. P.	F40T12	\$	7	8	a	•		_	_	٥	¥	1 Zone Switch	1.0	-	0.77	181

Table G-1 Baseline Lighting Systems and Energy Use

_	Bullding Name	Room No / Task Type Lemp Type Watts/ Name Code Code Lemp Type Lamp	Task Code	Code	Lamp Type	Watts/ Lamp	Lamp/ Fixture	Watts/ Fixture	Lamp/ Watts/ No of Fixture Fixture	No of Messured Ceiling Ceiling Wall Floor Window Fixtures Light (FC) Height (ft) Color Color Color Code	Celling Height (ft)	Celling Color	Wall	Floor	Window	Remarks	Demand Factor	Demand Fixture Factor (Hr/Wk)	Present Demand	Present Use
117-2 Boiler Building		Gmd Fir	7	P-Ind	Gmd Fir 14 P-Ind F40T12	\$	-	8	6			-	_	۵	ž		9,0	75	0.95	711
Boller Bullding		Basement- Wtr Trtmnt	7	P.Ind	F40T12	\$	8	88	ន	Ж	8	Σ	Σ	Σ	₹	2 x 3-Way Switches	9.0	*	1.98	1,481
Boiler Building		Basement- Open Area	4	P	F40T12	Q	8	8	6	8	6 -0	Σ	Σ	¥	ž	•	9.0	73	1.63	1,24
Boiler Building		Exterior	E E	w	¥	175	-	198	8	¥ Z	¥ Z	ž	¥	ž	ž	Photocell Control	1.0	æ	38	17,297
Boller Building		Note: Above information for the boiler plant includes only	formatio	n for the	boiler plant in	dudes on	ly the are	as presen	itly in active	y the areas presently in active use. Remaining areas not used, thus, lighting retroffis are not applicable.	ning areas no	x used, th	us, lighti	ng retroffs	are not ap	licable.				

Table G-1 Baseline Lighting Systems and Energy Use

Building	Building Name	Room No ! Name	Task	Type Code	Lamp Type	Watts/ Lamp	Lamp ^r Fixture	Watts/ Fixture	No of Fixtures	Measured Light (FC)	Celling Height (ft)	Celling Color	Wall Color	Floor	Window	Remarks	Demand Factor	Fixture (Hr/WK)	Present Demand	Present Use
117-3	Decontam & Small Parts	Supervisor Office	4	œ	F40T12	ş	-	172	۰	æ	8.0.	_	۵	Σ	¥	2 Zone Switches	0.7	8	1.55	5,409
117-3	Decontam & Small Parts	Corridor	-	v	F40T12	4	4	12	7	8	8.0	٦	٥	Σ	¥	1 Zone Switch	1.0	8	0.34	1,717
117-3	Decontam & Small Parts	Men's W/C	•	Ø	F40T12	\$	4	172	7	ĸ	8	_	Σ	₹	Š	1 Zone Switch	9.0	8	0.34	1,030
117-3	Decontam & Small Parts	Janitor's Closet	5	Ø	-	8	-	5	-	83	ę, G	_	Σ	∑	ž	1 Zone Switch	1.0	€0	0.10	4
117-3	Decontam & Small Parts	Women's W/C	•	Ø	F40T12	\$	4	172	7	S	8	_	Σ	Σ	¥	1 Zone Switch	9 ;	8	0.34	1,030
117.3	Decontam & Small Parts	Women's Lounge	•	Ø	F40T12	9	4	172	-	‡	8. -Q.	_	¥	Σ	¥	1 Zone Switch	9.0	8	0.17	515
117-3	Decontam & Small Parts	Control Room	4	œ	F40T12	\$	•	12	4	8	8 -3	_	2	Σ	ž	2 Zone Switches	0.7	8	2.82	10,218
117.3	Decontam & Small Parts	Mechanical Room	5	Ā	F40T12	₽	8	8	8	8	8-6	_	¥	۵	≰		1.0	75	4.82	6,010
117.3	Decontam & Small Parts	Loading Dock	7	P.E.P	F48T12VH	110	7	220	12	•	10 to 12	_	Σ	۵	¥		0.8	8	3.00	11,981
117.3	Decontam & Small Parts	Work Corridor	7	P.ExP	F48T12VH	5	7	88	4	a	11.0	_	_	۵	¥	•	0.8	8	11,00	43,930
117-3	Decontam & Small Parts	Inert Storage	‡	a.	F40T12	4	8	8	g	ĸ	11.0	_	_	۵	₹	•	8.0	8	2.75	10,990
117-3	Decontam & Small Parts	Breakdown Area	‡	P-EXP	F48T12VH	110	7	<u>8</u> 2	•	•	At Ceiling	_	_	٥	₹	1 Zone Switch	0.8	8	1.50	2,990
117.3	Decontam & Small Parts	10, Cell 6	7	PER	F48T12VH	110	7	220	8	•	At Ceiling	_	_	٥	¥	1 Zone Switch	0.8	8	0.50	1,997
117-3	Decontam & Small Parts	9, Cell 5	7	P.E.	F48T12VH	110	7	220	8		At Ceiling	٦	ب	۵	¥	1 Zone Switch	0.8	8	0.50	1,997
117-3	Decontam & Small Parts	8, Cell 4	7	P-ExP	F48T12VH	5	7	220	•	•	At Ceiling		ب	۵	¥	1 Zone Switch	9.0	8	1.50	2,990
117-3	Decontam & Small Parts	7, Cell 3	7	P-Ego	F48T12VH	5	7	720	•	8	At Ceiling	_	_	۵	¥	1 Zone Switch	0.8	88	5.	2,890
117.3	Decontam & Small Parts	6, Cell 2	7	P-ExP	F48T12VH	5	7	82	•	8	At Ceiling	_	ب	۵	¥	1 Zone Switch	0.8	88	2 .	2,890
117-3	Decontam & Small Parts	5, Cell 1	7	P.Ego	F48T12VH	110	7	520	•	8	At Ceiling		٦	۵	¥	1 Zone Switch	0.8	88	35.	2,890
117.3	Decontain & Small Parts	Exit Signs	ă	Ø	Œ	•	8	8	4	ž	ž	ž	ž	ž	₹	•	1.0	168	0.24	2,097
117.3	Decontam & Small Parts	Exterior	ā	S	AN.	175	-	188	£	¥	¥N	ž	ž	ž	¥	Photocell & Switches	1.0	2	8.51	37,189

Table G-1 Baseline Lighting Systems and Energy Use

Building Number	Building Name	Room No /	Task	Code	Lamp Type	Watts/ Lamp	Lamp/ Fixture	Watts/ Fixture	No of Fixtures	Measured Light (FC)	Celling Helght (ft)	Color Color	Wall	Floor	Window	Remarks	Demand Factor	Fixture (Hr/WK)	Present Demand	Present Use
117.4	Bulk Explosives Disposal	AG Work Corridor	7	P-ExP	F48T12VH	110	2	520	4	82	11.0	_	×	۵	¥	2 Zone Switches	100	8	3.50	17,472
1174	Bulk Explosives Disposal	AG Cell 1	4	P.Ego	¥	6	-	84	∞	8	10-01	Σ	¥	Σ	¥	2 Zone Switches	1.0	88	3.68	18,371
117.4	Bulk Explosives Disposal	AG Cell 1	2	SER	F48T12VH	110	7	220	7	12		Σ	¥	Σ	¥	1 Switch	1.0	82	0.50	2,486
1174	Bulk Explosives Disposal	AG Cell 2	7	P.ExP	¥	6	-	94	œ	7	10.0	Σ	¥	¥	¥	2 Zone Switches	1.0	8	3.68	18,371
117.4	Bulk Explosives Disposal	AG Cell 2	4	SEP	F48T12VH	110	7	220	S.	5	11.0	Σ	Σ	2	¥	1 Switch	1.0	8	1.25	6,240
117-4	Bulk Explosives Disposal	AG Roof	‡	P-EgP	-	8	-	8	4	ž	¥	ž	ş	¥	¥	1 Switch	1.0	8	0.40	1,897
117-4	Bulk Explosives Disposal	AG Exit		Ø	u	•	8	8	7	ž	ž	¥	ž	¥	¥	•	1.0	88	0.04	349
117-4	Bulk Explosives Disposal	Exterior	ğ	w	M	175	-	88	m	¥	ž	ž	ž	¥	¥ Z	Photocell Control	1.0	3	0.59	2,585
117.4	Bulk Explosives Disposal	UG Control Room	4	œ	F40T12	9	4	172	1	90/40	. 0- .8	_	Σ	ب	¥	Bi-level Switching	6.0	8	2.82	13,137
117.4	Bulk Explosives Disposal	UG Mech Room	5	Pig	F40T12	9	7	8	8	ន	9		_	Σ	Š	1 Switch Zone	1.0	75	2.82	3,649
117.4	Bulk Explosives Disposal	UG Toilet - Women	60	Ø	F40T12	Q	•	172	8	જ્ઞ	8.0.	۔۔	¥	Σ	¥	1 Switch Zone	9.0	88	0.34	1,030
117-4	Bulk Explosives Disposal	Women's Lounge	•	w	F40T12	\$	4	271	-	134	8.0	_	¥	Σ	¥	1 Switch Zone	0.8	8	0.17	515
1174	Bulk Explosives Disposal	UG Comidor	-	Ø	F40T12	\$	4	172	8	ĸ	8.0.	_	Σ	Σ	¥	1 Switch Zone	9.0	8	94	1,374
117.4	Bulk Explosives Disposal	UG Toilet - Men	•	Ø	F40T12	\$	4	172	8	8	.O-36	ب	∑	≨	¥	1 Switch Zone	9.0	8	0.34	1,030
117.4	Bulk Explosives Disposal	UG Janitor Closet	₽	Ø	_	5	-	5	-			_	≨	Σ	¥	1 Switch Zone	1.0	80	0.10	2
117.4	Bulk Explosives Disposal	UG Exit Signs	ā	Ø	u.	60	7	8	7			₹	Š	¥	¥		1.0	168	0.14	1,223
174	Bulk Explosives Disposal	Exterior	Ē	Ø	¥	175	-	8	8	ž	¥	¥	Š	ž	Ą	Photocell Control	1.0	2	0.40	1,730
1174	Bulk Explosives Disposal	UG Super's Office	4	ဖ	F40T12	₽	-	S	6	90/45	.O. 6	٦	٦	7	¥	Bi-level Switching	0.9	8	0.30	1,348

Table G-1 Baseline Lighting Systems and Energy Use

Building Number	Building Name	Room No / Name	Task Code	Type Code	tmp Type	Watts/ Lamp	Lamp/ Fixture	Watts/ Fixture	No of Fixtures	Measured Light (FC)	Ceiling Height (ft)	Celling Color	Wall	Floor	Window	Remarks	Demand Factor	Fixture (Hr/WK)	Present Demand	Present Use
117-5	Refining Building	Exterior		တ	A V	175	-	<u>\$</u>	18	¥	¥	ž	ž	ž	₹2	Photocell Control	0.1	2	3.17	13,838
117-5	Refining Building	Toilet - Mens'	∞	Ø	F40T12	4	7	8	၈	32	6 ,0	_	Σ	۵	ž	1 Switch Zone	0.6	88	0.28	55
117.5	Refining Building	Corridor	-	Ø	F40T12	4	7	8	-	8	8	_	۔	≆	¥	1 Switch Zone	0.7	8	0.09	301
117-5	Refining Building	Toilet - Womens'	80	Ø	F40T12	₽	7	8	7	Q	8.0	_	Σ	۵	¥	1 Switch Zone	9.0	8	0.17	515
117-5	Refining Building	Lounge - Women's	∞	Ø	F40T12	\$	8	8	-	\$	8, _Q	۔	Σ	۵	¥	1 Switch Zone	9.0	8	0.00	82
117-5	Refining Building	Janitor's Closet	9	Ø	_	5	-	5	-		8; Q	_	Σ	۵	ž	1 Switch Zone	1.0	12	0.10	8
117-5	Refining Building	Mechanical Room	\$		F40T12	4	7	8	\$	‡	8 . Q.		۔	۵	¥	2 x 3-Way Zones	9.0	88	3.44	13,738
117-5	Refining Building	Gmd Level Processing	7	P-ExP	F48T12VH	110	6	220	5	8	12-0.	۵	Σ	۵	ž	Separate Switches	1.0	8	3.75	18,720
117-5	Refining Building	2nd Level Processing	‡	P-ExP	F48T12VH	100	8	220	5	10 to 50	7-6"	۵	Σ	Grate	¥	Separate Switches	1.0	88	3.00	14,976
117-5	Refining Building	Top Level Processing	‡	P.Ego	F48T12VH	110	8	82	5	•	At Roof	_	Σ	۵	¥	Separate Switches	0.1	8	6.4	19,988
117-5	Refining Building	Top Level Processing	7	P.E.P	Ī	6	-	9	∞	•	At Roof	_	Σ	٥	¥	Separate Switches	0.	8	3.68	18,371
117-5	Refining Building	Exit Signs	ā	တ	u.	•	7	8	£	ž	¥	ž	ş	¥	ž		1.0	8	0.22	1,922
117-5	Refining Building	Loading Docks	Đ.	P.Ego	P-ExP F48T12VH	110	2	250	71	¥N	N	¥	¥	¥	¥	2 Switch Zones	0.1	\$	3.50	15,288

Building Number	g Building Name	Room No / Name	Task	Type	Lamp Type	Watts/ Lamp	Lamp/ Fixture	Watts/ Fixture	No of Fixtures	Measured Light (FC)	Celling Height (ft)	Celling Color	Wall	Floor	Window	Remarks	Demand Factor	Fixture (Hr/WK)	Present Demand	Present Use
117-6	Steamout Building	South Tower	14	P.ExP	F48T12VH	110	7	250	8	5	See Plans			Σ	¥	LV Switches 4 Ea.	5	8	4.50	22,484
117-8	Steamout Building	South Tower	7	P.ExP	¥	8	-	8	5	6	See Plans	_		Σ	¥	LV Switches 4 Ea.	0.	8	5.52	27.558
117-6	Steamout Building	Mechanics Brk. Room	17	۵	F40T12	9	8	8	8	ĸ	10.0	_	ب	Σ	ž	4 Zone Switches	9.0	8	3.10	12,384
117-8	Steamout Building	Corridor	-	Ø	F40T12	4	4	172	4	5	G	۔	۔	-4	¥	2 3-way Switches	9.0	88	0.69	2,061
117-6	Steamout Building	Toilet - Mens	∞	Ø	F40T12	Q	4	172	7	8	8 -0.		ب	¥	¥	1 Switch	9.0	8	0.34	1,030
117-6	Steamout Building	Toilet - Womens'	80	Ø	F40T12	\$	4	172	7	5	8; O.	_	_	Σ	ž	1 Switch	9.0	8	0.34	080,
117-8	Steamout Building	Womens' Lounge	∞	Ø	F40T12	\$	4	172	-	5	8.0	٠.	ب	¥	¥	1 Switch	9.0	88	0.17	515
117-6	Steamout Building	Janitor's Closet	6	Ø	-	150	-	150	-	•	8.0	_	ب	Σ	¥	1 Switch	6.	5	0.15	3
117-8	Steamout Building	9	18	œ	F40T12	4	•	172	7	57	.O.	_	¥	Σ	ž	2 Switches	0.7	8	8	4.207
117-8	Steamout Building	Mechanical Room North	5	P-Ind	F40T12	\$	7	88	2	8	10.0	٦	٠,	۵	¥	2 Zone Switches	9.0	88	3.61	14,425
117-6	Steamout Building	Exit Signs	Ð	Ø	u.	•	7	8	\$	ž	ž	ž	¥	ž	¥	•	1.0	8	0.36	3,145
117-8	Steamout Building	Exterior	Edi	ဖ	MV	175	-	86	ŧ	ž	ž	¥	₹	Š	¥	Photocell Control	1.0	2	2.97	12,973
117-6A	Pump Building	Pumpe	7	P-Ind	F40T12	Q	7	88	5	\$	15:0"	_		₹	¥	Panel Ckt Brkr	9,0	88	98.0	2,578
117-8A	Pump Building	Exterior	Ed	S	MV	175	-	198	ဗ	ž	¥	¥	₹	ž	ž		1.0	æ	0.59	2,585
117.7	Water Treatment	Filter Room	7	P-ExP	MH	400	-	8		19			≥	0	ž		9.0	85	4.14	21,700
117.7	Water Treatment	Control Rm	4	Ø	F40T12	₽	4	172	ĸ	8	10-0	۔	2	۵	₹	1 Switch	1.0	8	98.0	7,513
117-7	Water Treatment	Chem Tanks	7	P.Ego	¥	8	-	94	ю	4	•	_	Σ	۵	₹ Ž	1 Switch	9.0	\$	1.38	7,233
117-7	Water Treatment	Basement Pump Room	7	P.Ind	F40T12	\$	7	88	9	•	٠				ž		9.0	8	98.0	4,508
117-7	Water Treatment	Exterior	ā	S	W	175	-	1 88	9	¥	N	¥.	«	₹	ž	2 Switches @ 4 + Photocell for 1	0.	2	86 .0	4,324

Table G-1 Baseline Lighting Systems and Energy Use

Building	Building Name	Room No / Name	Task Code	Type Code	Type Lamp Type Code	Watts/ Lamp	Lemp/ Fixture	Watts/ Fixture	No of Fixtures	Measured Light (FC)	Celling Height (ft)	Celling Color	Wall	Floor	Window	Remarks	Demand Factor	Fixture (Hr/WK)	Present Demand	Present Use
117-8	Mech. Removal Building	Supervisor's Office	-	œ	F40T12	ş	-	172	7	8	8.0.			Σ	¥	1 Switch	9.0	8	0.34	1,374
117-8	Mech. Removal Building	Comidor	-	Ø	F40T12	4	4	172	8	ĸ	8.0.	ب	ب	Σ	¥	2 3-way Switches	0.6	88	0.34	1,030
117-8	Mech. Removal Building	Men's W/C	∞	Ø	F40T12	\$	•	12	8	82	8.0	ب	ب	Σ	¥	1 Switch	0.6	8	0.34	1,030
117-8	Mech. Removal Building	Jan Closet	9	Ø	-	5 5	-	2 5	-	82	8-0	ب	ب	Σ	¥	1 Switch	1.0	5	0.15	æ
117-8	Mech. Removal Building	Women's W/C	••	Ø	F40T12	\$	•	172	8	8	8.0	ب	Σ	¥	ž	1 Switch	9.0	8	0.34	080,
117-8	Mech. Removal Building	Women's Lounge	•0	Ø	F40T12	Q	•	17	-	120	-0-	ر	Σ	Σ	¥	1 Switch	9.0	8	0.17	515
117-8	Mech. Removal Building	Working Corridor	7	P.E.	F48T12VH	10	7	92	*	સ	11:0.	ر	Σ	۵	¥	2 Zone Switches	1.0	88	6.00	29,952
117-8	Mech. Removal Building	Mechanical Room	6	P-Ind	F40T12	\$	7	8	ĸ	æ	12-0"	ب	ب	۵	ž	1 Switch	8.	8	2.15	8,586
117-8	Mech. Removal Building	4, Cell 1	7	SER	F48T12VH	5	7	520	4	81	12-0"	ب	ب	۵	¥	1 Switch	1.0	88	9.	4,992
117-8	Mech. Removal Building	5, Cell 2	‡	S-EAP	F48T12VH	110	7	9 2	4	81	12-0"	ب	J	۵	¥	1 Switch	0,1	88	9.	4,892
117-8	Mech. Removal Building	6, Cell 3	#	SER	F48T12VH	10	8	92	4	82	12-0"	_	ب	۵	¥	1 Switch	1.0	8	9.	4,982
117-8	Mech. Removal Building	2, Boxing Area 1	7	SER	F48T12VH	110	8	280	8	81	12.0"	ب	ب	۵	ž	1 Switch	6.	8	0.50	2,496
117-8	Mech. Removal Building	3, Boxing Area 2	‡	SER	F48T12VH	110	7	280	7	18	12.0"	ب	ب	۵	Š	1 Switch	0.	88	0.50	2,496
117-8	Mech. Removal Building	10, Control Room	•	œ	F40T12	4	4	<u>t</u>	6	120/75	10.0	ب	¥	Σ	¥	Bilevel Switch	8.0	88	1.72	698'9
117-8	Mech. Removal Building	Edt Signs	Ö	Ø	u.	•	~	8	•	¥	ž	Š	₹	¥	ž	•	1.0	\$	0.12	1,048
117-8	Mech. Removal Building	Exterior	E E	S	¥	175	-	198	۰	NA.	NA.	¥	¥	¥	¥	Photocell Control	1.0	2	1.78	7,784

Table G-1 Baseline Lighting Systems and Energy Use

Building Number	Building Name	Room No /	Task Code	Type Code	Lamp Type	Watts/ Lamp	Lamp/ Fixture	Watts/ Fixture F	No of Fixtures	Measured Light (FC)	Celling Height (ft)	Celling Color	Wall	Floor	Window	Remarks	Demand Factor	Fixture (Hr/WK)	Present Demand	Present Use
117-10	Preparation Building	Distribution Area	4	P.EXP	F48T12VH	5	~	750	75		11.0		ر ا	۵	ž	•	0,1	8	8.8	29,952
117-10	Preparation Building	Working Comidor	4	P.EXP	P.EXP F48T12VH	110	7	220	8		11.0	_	ب	۵	∢ Z	•	1.0	8	6.50	32,448
117-10	Preparation Building	Off-Loading Area	7	P.EXP	F48T12VH	110	~	220	24		11:0	_		۵	¥ X	•	1.0	8	6.00	29,862
117-10	Preparation Building	2 == +	4	P-EXP	F48T12VH	110	7	220	4	91	11.0	_	ب	۵	ď Z	1 Switch	1.0	8	8.	4,992
117-10	Preparation Building	Cell 2	7	P.EXP	F48T12VH	110	7	220	4	ŧ	1.0	_	_	٥	₹	1 Switch	1.0	88	8.	4,992
117-10	Preparation Building	ე ₽	7	P.EXP	P.EXP F48T12VH	5	7	220	•	8	11.0	_	_	۵	X A	1 Switch	1.0	8	8.	4,992
117-10	Preparation Building	2 ≣ 4	4	P-EXP	F48T12VH	110	8	220	•	8	11:0	ب	J	۵	¥ X	1 Switch	1.0	88	9.	4,992
117-10	Preparation Building	Ce ≣ 55	‡	P-EXP	F48T12VH	10	8	82	4	ä	11:0	_	_	۵	Š	1 Switch	0.1	88	9.	4,992
117-10	Preparation Building	8	‡	P-EXP	F48T12VH	110	8	2 2	•	51	1.0	ب	۰	۵	¥ Z	1 Switch	1.0	88	8.	4,992
117-10	Preparation Building	Corridor	-	œ	F40T12	Q	•	172	8	8	8. Q.	٠.	2	_	¥ Z	2 3-way Switches	0.7	88	0.34	1,202
117-10	Preparation Building	Control Rm	•	œ	F40T12	\$	•	172	15	75	10.0	۔	¥	_	¥	2 3-way Switches	0.8	8	2.58	10,303
117-10	Preparation Building	Women's W/C	•	œ	F40T12	Q	4	172	7	115	8. O	_	ž	Σ	ž	1 Switch	9.0	8	0.34	1,030
117-10	Preparation Building	Women's Lounge	€0	œ	F40T12	\$	4	172	-	8	9. Ç	_	¥	Σ	ž	1 Switch	9.0	8	0.17	515
117-10	Preparation Building	Men's W/C	80	œ	F40T12	₽	4	221	8	8	8.0	ب	2	Σ	¥	1 Switch	9.0	8	0.34	1,030
117-10	Preparation Building	Janitor's Closet	6	ø	_	92	-	8	-	<u>8</u>		ب	Σ	Σ	≤	1 Switch	0.7	12	0.15	ı
117-10	Preparation Building	Supervisor's Office	4	œ	F40T12	\$	4	172	80	2	10.0	ب	₹	_	ž	2 3-way Switches	0.8	88	1.38	5,485
117-10	Preparation Building	Mechanical Room	ŧ	P-ind	F40T12	4	7	28	æ	45-50	8 -0.	_	_	۵	Š	2 Zone Switches	8.	88	4.73	18,890
117-10	Preparation Building	Edt Signs	ğ	Ø	u.	•	8	8	5	¥	¥	ž	ž	¥	₹	•	6.	88	0.32	2,786
117-10	Preparation Building	Exterior	ŧ.	ø	₽¥	175	-	88	15	¥	ž	¥	ž	₹	¥	Photocell Control	1.0	\$	2.97	12,973

F.NPRO.A1640316NENGRILITE-ECO.XLS Existing

Table G-1 Baseline Lighting Systems and Energy Use

Building Number	Building Name	Room No / Name	Task Code	Type Code	Room No / Task Type Lamp Type Watts/ Name Code Code Lamp Type Lamp	Watts/ Lamp	Lamp/ Fixture	Watts/ Fixture	No of Fixtures	Measured Light (FC)	Celling Height (11)	Color	Waii	Floor	Window	Remarks	Demand Factor	Fixture (Hr/WK)	Present Demand	Present Use KWH/Yrl
117-11	117-11 Accumulator Building	N Pump Room	4	S-ExP	14 S-ExP F48T12VH	110	7	250	2	32	At Roof	٦	Σ	۵	¥.	1 Switch Zone	0.4	8	0.50	8
117-11	117-11 Accumulator Building	N Accumu- lator Room	7	S-ErP	S-EAP F48T12VH	110	8	220	ю	88	At Roof	۔	Σ	۵	¥	1 Switch Zone	9.0	8	1.2	2,496
117-11	117-11 Accumulator Building	Boxing Room 14	7	SEXP	S-ExP F48T12VH	10	7	952	œ	8	At Roof	۔	Σ	۵	ž	1 Switch Zone	9.0	88	2.00	3,994
117-11	117-11 Accumulator Building	S Accumu- lator Room	4	S-Ev	S-EAP F48T12VH	5	8	290	w	8	At Roof	ب	¥	۵	¥	1 Switch Zone	9.	8	1.25	2,496
117-11	117-11 Accumulator Building	S Pump Room	4	S-Ev	S-EAP F48T12VH	110	~	520	8	ಹ	At Roof	_	¥	٥	¥	1 Switch Zone	0.4	8	0.50	88
117-11	117-11 Accumulator Building	Exterior	E E	S	MV	175	-	198	8	V	¥	¥	¥	¥	¥	Photocell Control	1.0	Z	0.59	2,595
117-15	117-15 Flashing Chamber	<	7	P-EAP	14 P-ExP F48T12VH 110	110	7	250	10	12	12-0	۵	¥	٥	¥	2 Switches	9.0	8	2.50	9,984
117-15	117-15 Flashing Chamber	œ	4	P-EAP	14 P.ExP F48T12VH 110	10	8	250	60	•	12-0"	٥	Σ	٥	¥	2 Switches	0.8	8	1.50	2,990

Table G-2. Lighting Systems Legend

Task Code	Description	Fixture Type Code	Description
1	Corridors	P	Pendant-Mounted Fixture
2	Kitchens	P-ExP	Pendant-Mounted Explosion Proof Fixture
3	Dining	P-Ind	Pendant-Mounted Industrial Fixture
4	Offices - General & Classrooms	R	Recessed Fixture
5	Conference	S	Surface-Mounted Fixture
6	Offices - Drafting	S-ExP	Surface-Mounted Explosion Proof Fixture
7	Laundry		,
8	Toilets / Locker Rooms	Ceiling, Wall a	nd Floor Colors
9	Sleeping Quarters	L	Light
10	Supply Rooms	М	Medium
11	Repair Shops	D	Dark
12	Storage Rooms		
13	Retail Stores		
14	Industrial Process	Window Code	
15	Mechanical / Electrical Room	NA NA	Not Applicable
16	Janitor's Closet		· · · · · · · · · · · · · · · · · · ·
17	Lounge / Break Room		
	Chemical Analysis Laboratory		
	Exterior Lighting		
Exit	Exit Light		

Lamp Type	Description
F32T8	Fluorescent Lamp, 48-inches long, 32 Watts, 1-inch diameter
F40T12	Fluorescent Lamp, 48-inches long, 40 Watts, 1-1/2-inch diameter
F40T12VH	Very High Output Fluorescent Lamp, 48-inches long, 110 Watts, 1-1/2-inch diameter
F, 6 Watt	Fluorescent Lamp for Exit Fixtures, 6 Watts
1	Incandescent Lamp
MV	Mercury Vapor Lamp
MH	Metal Halide Lamp

F:VPROJ1640316/ENGRILITE-ECO.XLS Schedules

Table G-3. Lighting Energy Use Factors

						Demand	Factors	per	Building				Γ
Task Code	Task Code Description	1-211	2-711	E-711	₽- ∠11	9-711		 \A9-\11	L-Z11	8-711	01-711	11-211	91-711
-	Corridors	8.0	¥	1.0	9.0	0.7	9.0	NA	ΝA	9.0	0.7	۸A	ΑĀ
2	Kitchens	NA	NA	ΝA	ΝA	NA	NA	NA	NA	ΝA	NA	NA	ΝΑ
3	Dining	NA	ΑN	ΝA	ΝA	NA	NA	NA	NA	NA	NA	NA	٧¥
4	Offices - General & Classrooms	0.7	NA	0.7	6.0	NA	NA	NA	1.0	0.8	8.0	NA	NA
5	Conference	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9	Offices - Drafting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ΝA
7	Laundry	NA	NA	NA	NA	NA	NA	ΝA	NA	NA	NA	٧V	NA
8	Toilets / Locker Rooms	9.0	NA	9.0	9.0	9.0	9.0	NA	NA	9.0	9.0	ΑN	AN
6	Sleeping Quarters	NA	NA	NA	NA	NA	NA	ΝA	ΑN	ΑN	ΑN	ΑN	ΑN
10	Supply Rooms	NA	NA	NA	NA	NA	NA	ΝA	NA	N A	AN	ΑN	AN
11	Repair Shops	NA	NA	NA	NA	NA	NA	NA	NA	۸	Ą	AN	ΑN
12	Storage Rooms	0.7	ΝA	NA	NA	NA	NA	NA	NA	AA	ΑN	ΑN	NA
13	Retail Stores	NA	NA	NA	NA	NA	NA	NA	NA	NA	۸A	NA	NA
14	Industrial Process	NA	9.0	0.8	1.0	1.0	1.0	9.0	9.0	1.0	1.0	0.4	0.8
15	Mechanical / Electrical Room	1.0	NA	1.0	1.0	0.8	8.0	NA	NA	0.8	0.8	AN	AA
16	Janitor's Closet	1.0	NA	1.0	1.0	1.0	1.0	NA	NA	1.0	1.0	Ā	Ą
17	Lounge / Break Room	1.0	NA	NA	NA	NA	0.8	NA	NA	ΑN	NA	A	۷¥
18	Chemical Analysis Laboratory	1.0	NA	NA	NA	NA	0.7	NA	۷A	۸A	ΑN	A	Ϋ́
Exit	Exit Lights	1.0	NA	1.0	1.0	1.0	1.0	NA	NA	1.0	1.0	ΑN	۸A
Extr	Exterior Lighting	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	ΝΑ

Table G-3. Lighting Energy Use Factors

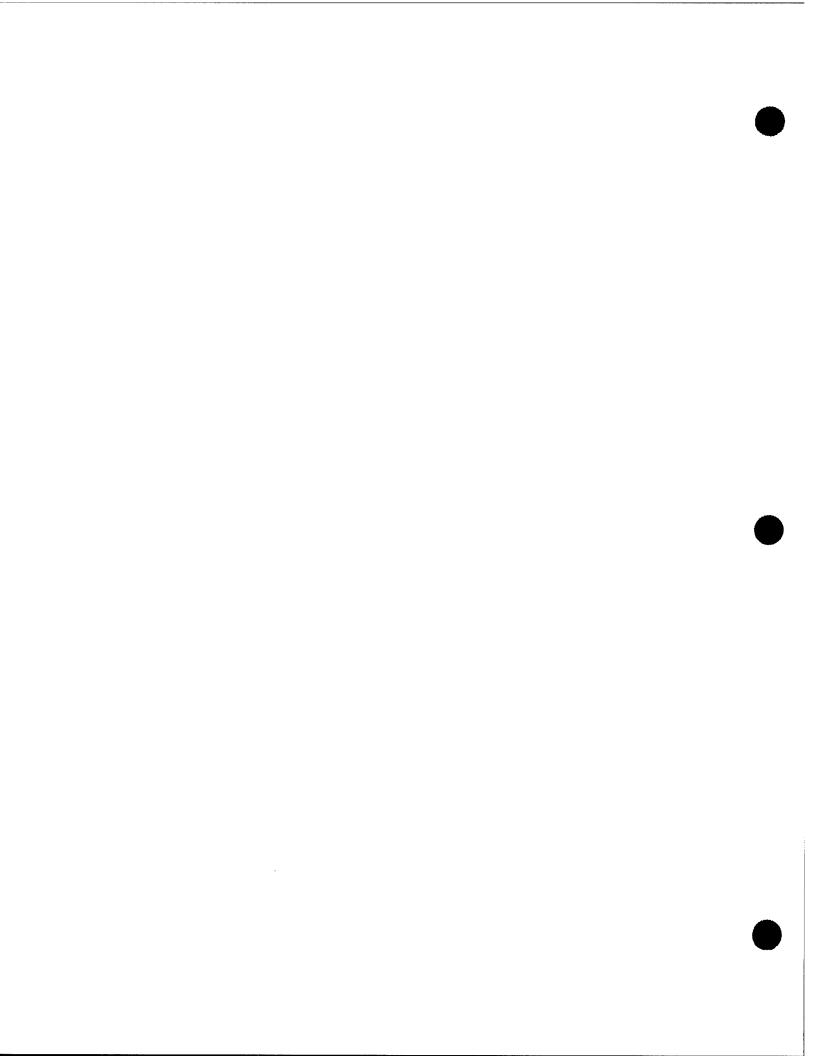
					Sch	eduled	Scheduled Hours/Week per	Week	oer Buil	Building			
Task Code	Task Code Description	1-211	2-711	£-711	1- /11	9-ZII	9-711	A9-711	۲-۲۱۱	8-711	01-711	11-211	91-711
1	Corridors	96.0	۸A	96.0	96.0	96.0	96.0	٩	٩V	96.0	96.0	AN AN	ΑN
2	Kitchens	NA	NA	ΝA	ΝA	NA	ΑN	٧N	۸N	¥	ΑN	AN	AN
င	Dining	NA	NA	ΝA	ΝA	٩N	ΑN	ΑN	ΝA	ΑN	AN	ΑN	ΑN
4	Offices - General & Classrooms	96.0	NA	96.0	96.0	۸×	NA	ΝA	168	96.0	96.0	ΑN	ΑN
5	Conference	NA	ΑN	ΝΑ	ΝA	ΑN	ΝA	۸N	ΑN	ΑN	ΑN	ΑN	ΑN
9	Offices - Drafting	ΑN	NA	NA	NA	NA	AN	ΝA	ΑN	ΑN	ΝΑ	AN	AN
7	Laundry	NA	NA	NA	NA	NA	ΑN	ΝA	ΑN	ΑN	ΑN	AN	ΑN
8	Toilets / Locker Rooms	96.0	NA	96.0	96.0	96.0	96.0	NA	ΑN	96.0	96.0	AN	ΑN
6	Sleeping Quarters	NA	NA	ΝA	NA	ΝA	NA	ΑN	۸N	NA	ΑN	NA	ΑN
10	Supply Rooms	NA	NA	NA	NA	NA	ΑN	ΝA	ΑN	ΝA	ΑN	AN	ΑN
11	Repair Shops	٧N	NA	NA	AN	AN	ΑN	ΝA	ΑN	NA	ΑN	ΑN	۸N
12	Storage Rooms	96.0	NA	ΑN	ΝA	ΝA	ΑN	۷V	AN	AN	ΝA	ΑN	Ϋ́
13	Retail Stores	NA	NA	NA	NA	NA	AN	ΑN	۸N	ΑN	ΑN	AN	ΑN
14	Industrial Process	NA	24.0	96.0	96.0	0.96	0.96	96.0	168	96.0	96.0	96.0	96.0
15	Mechanical / Electrical Room	4.0	NA	24.0	24.0	96.0	96.0	ΝA	ΑN	96.0	96.0	AN	ΑN
16	Janitor's Closet	12.0	NA	8.0	8.0	12.0	12.0	NA	ΑN	12.0	12.0	ΑN	AN
17	Lounge / Break Room	96.0	NA	NA	NA	NA	96.0	AN	¥	Ϋ́	ΑN	ΑN	ΑN
18	Chemical Analysis Laboratory	96.0	NA	NA	NA	۸N	96.0	ΑN	٩×	٨	NA	ΑN	ΑĀ
Exit	Exit Lights	168	NA	168	168	168	168	AN	ΑN	168	168	ΑN	Ą
Extr	Exterior Lighting	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	Α×

Note: WADF facilities schedules varry depending on the work load. Assume 2 shifts per day, 6 days per week.

Table G-4. Existing Lighting Fixture Electric Demands

Existing Fixture Type Description	Watts per Fixture
F40T12 - 2 Lamps per Fixture - Standard Fixture	86.0
F40T12 - 4 Lamps per Fixture - Standard Fixture	172.0
Exit Light: F-6W - 2 Lamps per Fixture	20.0
F40T12 - 1 Lamp per Fixture - Standard Fixture	50.0
F40T12 - 2 Lamps per Fixture - Standard Fixture	86.0
F40T12 - 2 Lamps per Fixture - Industrial Fixture	86.0
F40T12 - 4 Lamps per Fixture - Standard Fixture	172.0
F40T12 - 4 Lamps per Fixture - Industrial Fixture	172.0
F48T12VH - 2 Lamps per Fixture - Explosion Proof Fixture	250.0
I-100W - 1 Lamp per Fixture - Ceiling & Wall Mounted	100.0
I-150W - 1 Lamp per Fixture - Ceiling & Wall Mounted	150.0
MV 175W - Pendant-Mount	198.0
MH 400W - Pendant-Mount	460.0

[&]quot;Standard Fixtures" are either recessed or surface mounted, including lens.



EEAP Energy Survey of Army Industrial Facilities Western Area Demilitarization Facility, HWAAP, Nevada **APPENDIX H Lighting Retrofit Calculations** \1640316\HAWTHORN.SRV 941026-1



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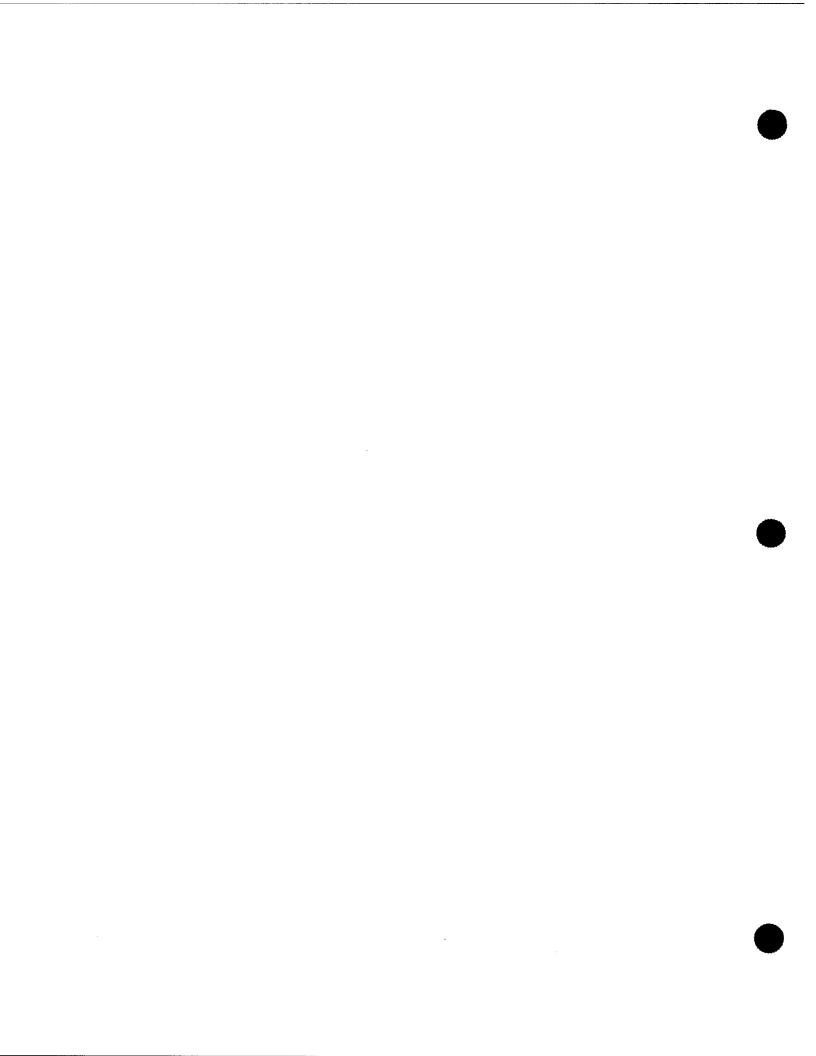
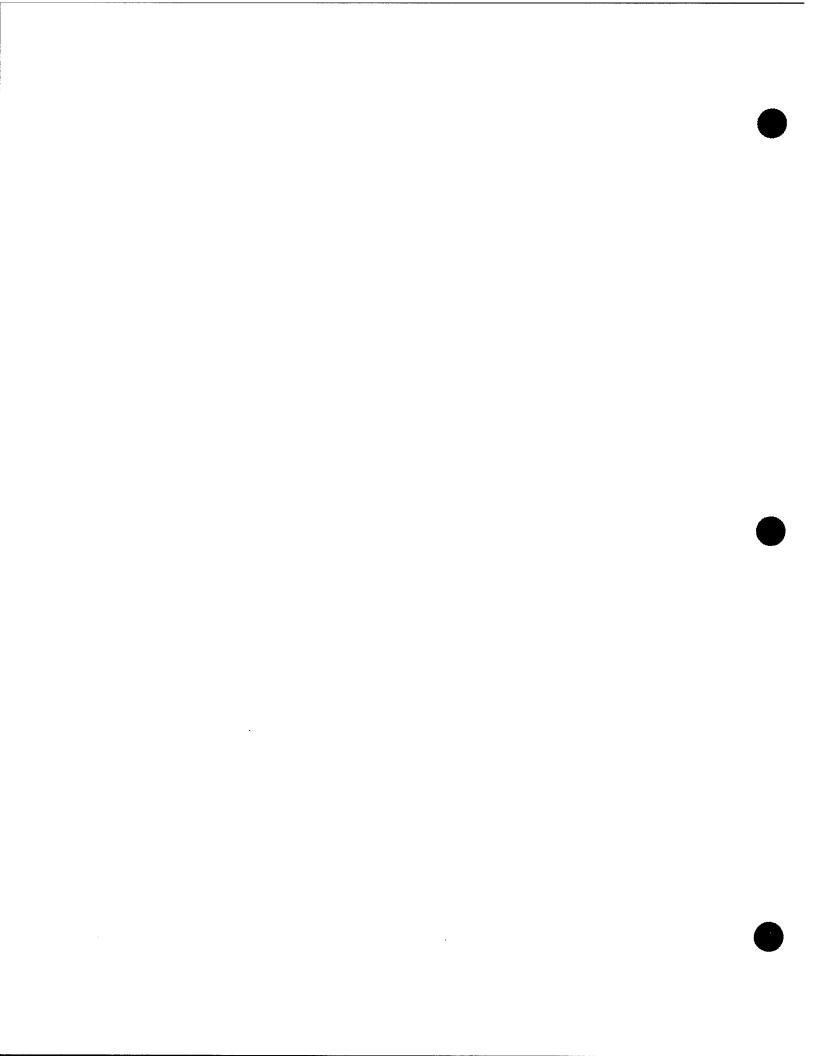


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Lighting Retrofit Calculations

Three types of energy saving retrofits are evaluated for study buildings:

- Lighting fixture delamping, lamp and ballast modifications
- Lighting fixture lamp, ballast and reflector modifications
- Lighting controls modifications

Specific measures evaluated for each type of retrofit include:

Lighting Fixture and Control Retrofits Evaluated

Lighting ECO	
Number	Description
LD-1	Delamp and Retrofit from 2-Lamp F40T12 Fixture to a 1-Lamp F32T8 Fixture with Electronic Ballast
LD-2	Delamp and Retrofit from 4-Lamp F40T12 Fixture to a 2-Lamp F32T8 Fixture with Electronic Ballast
LF-1	Retrofit LED Lamp Kit in Existing Exit Lights
LF-2	Retrofit Electronic Ballast & 1xF32T8 Lamp in Existing 1-Lamp F40T12 Fixtures
LF-3A	Retrofit Electronic Ballast & 2xF32T8 Lamps in Existing Standard 2-Lamp F40T12 Fixtures
LF-3B	Retrofit Electronic Ballast & 2xF32T8 Lamps in Existing Industrial 2-Lamp F40T12 Fixtures
LF-4A	Retrofit Electronic Ballast & 4xF32T8 Lamps in Existing 4-Lamp F40T12 Fixtures, or
LF-4B	Delamp to 2xF32T8 Lamps & Install Reflector & Electronic Ballast in 4-Lamp F40T12 Fixtures
LF-5	Replace 100W Incandescent Lamp and Base with DTT-26W, 2700K, CRI 82 Compact Fluorescent & Ballast
LF-6	Replace 150W Incandescent Lamp and Base with DTT-26W, 2700K, CRI 80 Compact Fluorescent & Ballast
LF-7	Retrofit Existing 175W MV Exterior Light Fixtures with 50W HPS Lamps & Ballasts
LF-8	Retrofit Existing 400W Metal Halide Explosion Proof Fixtures with 250W HPS Lamps & Ballasts
LC-1	Lighting Control Retrofit: Install Ceiling-Mounted Passive Infrared (PIR) Motion Sensors
LC-2	Lighting Control Retrofit: Install Ceiling-Mounted Ultrasonic Motion Sensors
LC-3	Lighting Control Retrofit: Replace Wall Switches with Passive Infrared (PIR) Motion Sensor Switches

Results of economic evaluations are summarized on Table H-1. Calculations for each project appear on Tables H-2 through H-13. Detailed cost estimates, Life Cycle Cost Analysis summary sheets and catalog data for selected components are appended.

Fixture Delamping and Modification Evaluations

Delamping is considered for rooms audited with excessive levels of illumination according to Illumination Engineering Society guidance.

Delamping of two- and four-lamp F40T12 fixtures is considered, including retrofitting with F32T8 lamps and electronic ballasts. Half of the lamps are removed in each of the two delamping projects.

Detailed calculations appear on Table H-2.

Fixture Retrofit Evaluations

Lighting fixture modifications are considered. Existing fluorescent fixtures use 40-watt T12 fluorescent lamps and standard ballasts. Room-by-room calculations of fixture modifications evaluated for study buildings appear as Tables H-3 through H-10.

Retrofit LF-1 proposes to replace existing 6-watt fluorescent lamps in exit signs with light emitting diode (LED) lamp kits.

Retrofits LF-2, LF-3A, LF-3B, and LF-4A are one-for-one fluorescent lamp and ballast replacements in existing fixtures. Retrofitting existing one-lamp fluorescent fixtures with electronic ballasts and 32-watt T8 lamps, for example, will reduce fixture input power by about 19 watts if standard core and coil ballasts are installed in existing fixtures.

Retrofit LF-4B involves installing a reflector and delamping existing 4-lamp fluorescent fixtures to two F32T8 lamps with electronic ballast. Retrofits LF-4A and LF-4B are evaluated for the same fixtures. The retrofit with the best economic analysis results is recommended.

Retrofits LF-5 and LF-6 are evaluated for replacing existing incandescent lamps in various fixtures with compact fluorescent lamps and ballasts. These retrofits involve modifying the fixtures such that only compact fluorescent lamps may be used.

Retrofit LF-7 involves the replacement of existing mercury vapor lamps with high pressure sodium lamps and ballasts.

Retrofit LF-8 replaces metal halide lamps with high pressure sodium lamps and ballasts.

Pricing shown on the attached unit cost estimates are taken, in large part, from the February 1994 issue of "Defense General Supply Center - Energy Efficient Lighting Catalog". Components are available at prices listed in this document to DoD agencies; it is assumed that contractor pricing would be similar. Catalog numbers are indicated on unit cost estimates.

Energy use for the existing fixtures is calculated in Appendix G. Energy savings and economic analysis calculations for proposed fixture retrofits use the following calculation methodology:

Lighting Retrofit Evaluation Calculations

Label	Contents / Calculation Explanation
KW_SVD	Difference in "Watts per Fixture" (E_KW) — (S_KW) = Demand savings (kW) from lighting retrofit values in Tables H-14 and H-15 (See note below)
KWH_SV	KW_SVD * HR/WK * 52 * Demand Factor = Usage Schedule (HR/WK) = Electric savings from retrofit and Demand Schedule are provided in Appendix G.
DEM_\$/Y	 KW_SVD * \$8.517 per kW-Mo * 12 Months per Year = Annual electric demand cost savings (Sierra Pacific demand charge, including Taxes)
USE_\$/Y	KWH_SVD * \$0.0438 = Annual electric power cost savings (Sierra Pacific power use charge, including Taxes)
PWR_LCC \$	[DEM_\$/Y + USE_\$/Y] * 12.02 = Life cycle savings, Life of 15 years; UPV
O&M_\$/Y	[Table H-14 \$/1000 LAMP-Hr - Table H-15 \$/1000 LAMP-Hr] * HR/WK * 52 * * No. FXTRS * NO. LAMPS / 1000 = Annual O&M savings (additional cost) for lamp replacements; refer to Tables H-14 and H-15
O&M_LCC \$	(O&M_\$/Y * 11.94) = Life cycle O&M cost for Life of 15 years; UPV
TOT_\$/Y	$(DEM_\$/Y + USE_\$/Y + O&M_\$/Y) = Total annual cost savings$
TOT_LCC\$	(O&M_LCC\$ + PWR_LCC\$) = Total life cycle cost savings
CONST\$	Retrofit Unit Cost * NO. FIXTURES = Construction cost from retrofit unit cost estimates, attached
SIOH	CONST\$ * 0.120 = SIOH and design at 6% each of construction cost
INVE\$T	CONST\$ + SIOH = Total investment per ECIP guidance
SIR	(TOT_LCC\$) / (INVE\$T) = Savings-to-investment ratio
PAYBCK	(INVE\$T) / (TOT_\$/Y) = Payback period (years)

Notes: Parameters shown above for existing and retrofit (savings) cases are indicated by prefixes: "E_" and "S_", respectively, corresponding to labels used above to explain lighting energy use calculations. Refer to Tables H-14 and H-15 for existing and proposed retrofit energy use and O&M costs.

Sierra Pacific Power Company presently has no rebate programs in effect.

Controls Retrofit Evaluations

Lighting control retrofits evaluated involve installing occupancy sensor switching in offices, conference rooms, bathrooms and other areas where lights are normally turned on for periods when no one is present. Three types of occupancy sensors are considered. A wall switch type passive infrared (PIR) sensor is evaluated as Retrofit LC-3. This is the least expensive control retrofit investigated and simply replaces a small office's toggle switch. For larger offices and open areas, ceiling mounted sensors are evaluated. Ceiling mounted switches are more expensive since a relay and additional wiring are required.

Retrofit LC-1 proposes single or multiple ceiling-mounted PIR sensors for larger rooms. Retrofit LC-2 evaluates ceiling-mounted ultrasonic occupancy sensors for bathrooms and toilets and other rooms where PIR sensors cannot "see" over partitions.

Detailed evaluations appear as Tables H-11 through H-13.

The percent savings anticipated for each room or area is listed on Tables H-11 through H-13. Energy savings of at least these levels have been achieved in many similar retrofits according to electric utility companies. Savings percentages used may be low for many offices observed during field investigations conducted for the study. In several buildings, many rooms were observed to be unoccupied at least 50 percent of the time (with lights left on). Manufacturers of occupancy sensor switches report savings of between 35 percent and 75 percent depending on the application. Therefore, all of the savings assumptions in these analyses may be considered conservative, since the savings percentages are at the lower end, or below the range of savings found by manufacturers.

Energy and cost savings are determined using the same formulae as are shown above for lighting energy use calculations. Energy consumption is factored down based on the assumed percent savings.

Table H-1. Summary of Lighting and Controls Retrofit Evaluations

Lighting ECO Number	Description	Number Retrofit Units	Demand Saved (kW)	Energy Saved (kWH/Year)	Electric Demand (\$/Year)	Electric Usage (\$/Year)	O&M Saved (\$/Year)	Total LCC Cost Saved (\$)	ECO Investment (\$)	SIR	Payback (Years)
LD-1	Delamp and Retrofit from 2-Lamp F40T12 Fixture to a 1-Lamp F32T8 Fixture with Electronic Ballast	4	0.22	879	\$22.49	\$38.44	\$6.89	\$815	\$302	2.69	4.46
LD-2	Delamp and Retrofit from 4-Lamp F40T12 Fixture to a 2-Lamp F32T8 Fixture with Electronic Ballast	57	6.33	22,109	\$647	\$967	\$196	\$21,745	\$5,268	4.13	2.91
LF-1	Retrofit LED Lamp Kit in Existing Exit Lights	18	1.47	12,879	\$151	\$563	(\$56.60)	\$7,908	\$6,037	1.31	9.18
LF-2	Retrofit Electronic Ballast & 1xF32T8 Lamp in Existing 1-Lamp F40T12 Fixtures	26	0.49	858	\$50	\$38	(\$1.12)	\$1,045	\$1,791	0.58	20.60
LF-3A	Retrofit Electronic Ballast & 2xF32T8 Lamps in Existing Standard 2-Lamp F40T12 Fixtures	187	4.68	18,592	\$478	\$813	(\$32)	\$15,133	\$15,144	1.00	12.03
1F-3B	Retrofit Electronic Ballast & 2xF32T8 Lamps in Existing Industrial 2-Lamp F40T12 Fixtures	324	8.10	21,890	\$828	\$958	(\$29)	\$21,118	\$24,973	0.85	14.22
LF-4A	Retrofit Electronic Ballast & 4xF32T8 Lamps in Existing 4-Lamp F40T12 Fixtures, or	118	5.90	24,448	\$603.01	\$1,070	(\$36)	\$19,671	\$18,190	1.08	11.12
LF-48	Delamp to 2xF32T8 Lamps & Install Reflector & Electronic Ballast in 4-Lamp F40T12 Fixtures	118	13.10	54,275	\$1,339	\$2,375	\$371	\$49,069	\$9,925	4.94	2.43
LF-5	Replace 100W Incandescent lamp and base with DTT- 26W, 2700K, CRI 82 Compact Fluorescent & Ballast	9	0.39	1,366	\$40	\$60	\$63	\$1,953	\$309	6.33	1.90
0-41	Replace 150W Incandescent lamp and base with DTT- 26W, 2700K, CRI 80 Compact Fluorescent & Ballast	3	0.35	215	\$35	6\$	\$6	\$604	\$154	3.91	3.07
LF-7	Retrofit Existing 175W MV Exterior Light Fixtures with 50W HPS Lamps & Ballasts	138	16.28	71,129	\$1,664	\$3,112	(\$261)	\$54,297	\$24,991	2.17	5.53
8-47	Retrofit Existing 400W Metal Halide Explosion Proof Fixtures with 250W HPS Lamps & Ballasts	48	7.68	38,818	\$785	\$1,698	\$175	\$31,934	\$10,980	2.91	4.13
LC-1	Lighting Control Retrofft: Install Ceiling Mounted Passive Infrared (PIR) Motion Sensors	24	0.00	9,715	0\$	\$425	\$0	\$5,109	\$9,566	0.53	22.51
TC-2	Lighting Control Retrofit: Install Ceiling Mounted Ultrasonic Motion Sensors	17	0.00	2,969	0\$	\$130	\$0	\$1,561	\$6,776	0.23	52.16
r-31	Lighting Control Retrofft: Replace Wall-Switches with Passive Infrared (PIR) Motion Sensor Switches	19	00.0	4,888	0\$	\$214	\$0	\$2,571	\$2,269	1.13	10.61
Total Succ	Total Successful Lighting Fixture and Controls Retrofits	661	50.5	225,149	\$5,161	\$9,851	\$468	\$186,029	\$75,380	2.47	4.87

Note: Lighting retrofits LF-4A and LF-4B address the same fixtures; the analysis with the best economics is recommended for implementation.

Table H-2 Delamping and Lighting Retrofit LD-1: 2-Lamp F40T12 to 1-Lamp F32T8 Fixtures

Building	Building Name	Room No /	Task A	Type	e e	Watts/	Lamp/	Watts/	No of	Demand	Fixture	Watts/ECO	Demand	Use Saved	Energy	O&M Saved	Total Saved	Total LCC\$	irvest-	œ	Psyback
Pallon.		Sall S	§ ,	8 6	R.	٠.			rixures	Lactor :	(HITWAK)	Fixare	Saved (KW)	(KWH/Yr)	(SVr)	(SWr)	(SWr)	Saved	mert (S)		(Years)
1-/11	Sewces & Support	72	-	<u></u>	F40T12	\$	7	8	m	9.0	88	æ	0.12	629	\$45.69	\$5.17	\$50.86	\$611	1223	2.69	4.46
117-1	Services & Support	24	-	œ	F40T12	9	2	98	1	9.0	88	3	90:0	82	\$15.23	\$1.72	\$16.95	\$204	\$76	2.69	4.46
Totals for ECO LD-1	ECO LD-1												0.22	878.59	\$60.93	\$6.89	\$67.82	\$814.59	\$302.45	2.69	4.46
Building Number	Building Neme	Room No / Name	Task So	T ye obs	Lamp	Watts/ Lamp	Lemp/ Fixture	Wetts/	No of Fixtures	Demand Factor	Fbdure (HrWW)	Watts/ECO Fixture	Demend Saved (KW)	Use Saved	Energy (\$/fr)	O&M Saved (\$/Yr)	Total Saved	Total LCC\$	invest-	Sis	Payback
117-1	Services & Support	-	-	œ	F40T12	\$	-			7.0	88	19	0.44	1,652	\$113.26	\$13.78	\$127.04	\$1,526	\$370	4.13	2.91
117-1	Services & Support	77	-	α	F40T12	\$	4	52	8	8.0	88	2	0.22	887	\$61.48	\$6.89	\$68.37	\$821	\$185	4,4	2.70
117-1	Services & Support	ន	•	<u>~</u>	F40T12	\$	4	Ē	8	2.0	8	5	0.22	776	\$56.63	\$6.89	\$63.52	\$763	\$185	4.13	2.91
117-1	Services & Support	ន	-	<u>~</u>	F40T12	\$	4	Ē	10	8.0	88	5	99.0	2,216	\$153.70	\$17.22	\$170.92	\$2,053	\$ 462	4.4	2.70
117-3	Decortam & Small Parts	Women's Lounge	•0	60	F40T12	\$	4	ជ	-	9.0	88	2	0.11	332	\$25.89	13.44	\$29.34	\$362	265	3.81	3.15
117-3	Decontam & Smell Parts	Control Room	•	<u>~</u>	F40T12	\$	4	ជ	4	2.0	88	5	1.89	6,594	\$481.37	\$58.56	\$539.92	\$6,485	\$1,571	4.13	2.91
17.4	Bulk Explosives Disposal	Women's	•0	ω	F40T12	\$	•	Ē	-	9.0	8	5	0.11	332	\$25.89	33.44	\$29.34	\$362	26\$	3.81	3.15
117-6	Steamout Building	Tollet - Mens'	••	ω	F40T12	\$	•	17	8	9.0	88	5	0.22	98	\$51.78	\$6.89	\$58.67	\$705	\$185	3.81	3.15
117-6	Steemout Building	Tollet - Womens'	••	w	F40T12	\$	•	Ē	8	9.0	8	2	0.22	99	\$51.78	\$6.89	\$58.67	\$708	\$185	3.81	3.15
117-6	Steemout Building	Womens'	•••	6	F40T12	\$	•	Ę	-	9.0	8	5	0.11	332	\$25.89	13.44	\$29.34	\$362	285	3.81	3.15
117-8	Mech. Removal Building	Ments W/C	•••	ω	F40T12	\$	4	12	8	9.0	88	5	0.22	999	\$51.78	\$6.89	\$58.67	\$706	\$185	3.81	3.15
117-8	Mech. Removal Building	Women's W/C	••	ω	F40T12	\$	•	172	8	9.0	8	5	0.22	999	\$51.78	\$6.89	\$58.67	\$705	\$185	3.81	3.15
117-8	Mech. Removal Building	Women's Lounge	••	ω	F40T12	\$	•	<u>t</u>	-	9.0	88	2	0.11	332	\$25.89	13.44	\$29.34	\$352	26\$	3.81	3.15
117-8	Mech. Removal Building	10, Control Room	•	~	F40T12	\$	•	<u>1</u> 2	5	8.0	88	5	-	4,433	\$307.40	134.44	\$341.85	\$4,106	\$354	4.4	2.70
117-10	Preparation Building	Women's W/C	•	e	F40T12	\$	•	172	8	9.0	8	5	0.22	98	\$51.78	\$6.89	258.67	\$705	\$185	3.81	3.15
117-10	Preparation Building	Women's	••	œ	F40T12	\$	•	172	-	9.0	8	6	0.11	332	\$25.89	13.4	\$29.34	\$ 362	263	3.81	3.15
117-10	117-10 Preparation Building	Men's W/C	•	~	F40T12	\$	•	172	2	9.0	86	61	0.22	986	\$51.78	\$6.89	\$58.67	\$705	\$185	3.81	3.15
Totals for ECO LD-2	ECO LD-2								29				6.33	22109.07	\$1,614	\$196.34	\$1,810	\$21,745	\$5,268	4.13	291

Energy Conservation Opportunity Legend

LD-1 Delemp and Retrofit from 2-Lamp F40T12 Fixture to a 1-Lamp F32T8 Fixture with Electronic Ballast

LD-2 Delamp and Retrofit from 4-Lamp F40T12 Fixture to a 2-Lamp F32T8 Fixture with Electronic Ballast

F:/PROJ/1640316/ENGR/LITE-ECO,XLS LF-1

Table H-3 Lighting Retrofit LF-1: Retrofit Light Emitting Diode (LED) Lamps in Exit Lights

Building Number	Bulkling Name	Room No / Task Type Lamp Watts/ Lamp/ Name Code Code Type Lamp Fixture	Code A	ار م م	Lemp Type	Task Type Lamp Watta/ Lamp/ Code Code Type Lamp Fixture		Watts/ Fixture	No of Fixtures	Demand Factor	Fixture (Hr/WK)	Watts/ECO Fixture	Demand Saved (kW)	Use Saved (KWH/Yr)	Energy (\$/Y1)	O&M Saved (\$/Yr)	O&M Saved Total Saved (\$PY)	Total LCC\$ Saved	invest- ment (\$)	쭚	Payback (Years)
117.1	117-1 Services & Support	Exit Signs	ā	w	ш	•	7	8	6	1.0	168	1.8	0.16	1,431	\$79.35	(\$6.29)	\$73.06	\$879	\$671	1.31	9.18
117-3	117-3 Decontam & Small Parts	Exit Signs	ā	Ø	ш	•	8	8	12	1.0	89	1.8	0.22	1,908	\$105.80	(\$8.39)	\$97.41	\$1,172	\$884	1.3	9.18
117-4	117-4 Bulk Explosives Disposal	AG Exit	ğ	Ø	u.	•	7	8	7	1.0	8	8.	0.04	318	\$17.63	(\$1.40)	\$16.24	\$185	\$149	1.3	8.18
117-4	Bulk Explosives Disposal	UG Exit Signs	ā	တ	u.	•	7	8	7	6,	8	8.	0.13	1,113	\$61.72	(\$4.89)	\$56.83	\$683	\$522	£.	9.18
117.5	Refining Building	Edt Signs	Ð	Ø	u	•	7	8	F	1.0	1 68	8.1	0.20	1,749	\$96.98	(\$7.69)	\$89.30	\$1,074	\$820	£.	9.18
117-6	Steamout Building	Exit Signs	ğ	Ø	LL.	•	8	8	\$	1.0	88	1.8	0.33	2,862	\$158.70	(\$12.58)	\$146.12	\$1,757	\$1,342	1.3	9.18
117-8	Mech. Removal Building	Exit Signs	ă	Ø	ш	•	8	8	•	0.1	168	1.8	0.11	28	\$52.90	(\$4.19)	\$48.71	\$586	\$447	<u>.3</u>	9.18
117-10	117-10 Preparation Building	Exit Signs Exit	ă	တ	L.	•	2	8	8	1.0	168	1.8	0.29	2,544	\$141.07	(\$11.18)	\$129.89	\$1,562	\$1,192	1.31	9.18
Totals for	Totals for ECO LF-1								19				1.47	12,879	\$714.15	(\$56.60)	\$857.55	806'2\$	\$6,037	1.31	9.18

Table H-4 Lighting Retrofit LF-2: Retrofit Electronic Ballast and 1 x F32T8 Lamp in Existing 1-Lamp F40T12 Fixtures

Building Number	Building Building Name Number	Room No / Task Type Lamp Watts/ Lamp/ Name Code Code Type Lamp Fixture	Code Age	C Jype	Lamp Type	Watts/ Lamp	Lamp/ Fixture	Watts/ Fixture	No of Fixtures	Demand Factor	F	ire Watts/ECO (VK) Fixture Si	Demand aved (kM	Use Saved Energy C	Energy (\$/Yr)	O&M Saved (\$/Yr)	O&M Saved Total Saved (\$/Yr) (\$/Yr)	Total LCC\$ Saved	i Invest- ment (\$)	쭚	Payback (Years)
117-1	117-1 Services & Support	75	-	œ	1 R F40T12 40	\$	-	S	-	9.0	88	31	0.02	76	\$5.28	(80.09)	\$5.17	\$62	\$69 0.90	0.90	13.33
117-2	117-2 Boller Building	Gmd Fir	7	P-Ind	14 P-Ind F40T12	₽	-	8	6	9.0	75	93	0.36	270	\$48.72	(\$0.45)	\$48.27	\$580	\$1,309	0.44	27.12
117-4	117-4 Bulk Explosives Disposal	UG Super's Office	4	ဖ	S F40T12 40	ş	-	8	•	6.0	8	31	0.11	512	\$34.06	(\$0.57)	\$33.49	\$403	\$413	0.97	12.34
Totals for	Totals for ECO LF-2								8				0.49	858	\$88.05	(\$1.12)	\$86.93	\$1,045	\$1,791 0.58	0.58	20.60

Table H-5 Lighting Retrofits LF-3A AND LF-3B: Retrofit Electronic Ballasts and F32T8 Lamps in Existing 2-Lamp F40T12 2-Lamp Standard and Industrial Type Fixtures

Building Number	Building Name	Room No / Name	Task Code	Type	Lamp V Type L	Watts/ Lamp/ Lamp Fixture		Watts/ Nk Fixture Fixt	No of De Fixtures Fa	Demand Fi Factor (H	Fixture V (Hr/WK)	Watts/ECO Foture	Demand Saved (kW)	Use Saved (kWH/Yr)	Energy (\$/Yr)	O&M Saved (\$/Yr)	Total Saved (\$/Yt)	Total LCC\$ Saved	Invest- ment (S)	SI T	Payback (Years)
117-1	Services & Support	•	8	œ	F40T12	Ş	2 8	88	12	1.0	88	10	0.30	1,498	\$96.19	(\$2.10)	\$94.09	\$1,131	\$972	1.18	10.33
117-1	Services & Support	•	8	œ	F40T12	\$	2 8	8	4	1.0	88	5	0.10	488	\$32.08	(\$0.70)	\$31.38	\$ 377	\$324	1.18	10.33
117.1	Services & Support	4	8	œ	F40T12	8	8	8	2	1.0	8	2	0.30	1,498	\$96.19	(\$2.10)	\$94.09	\$1,131	\$972	1.16	10.33
117-1	Services & Support	0	17	œ	F40T12	8	2 8	., 8	8	0.1	8	5	0.55	2,748	\$176.34	(\$3.84)	\$172.50	\$2,074	\$1,782	1.16	10.33
117-1	Services & Support	5	80	æ	F40T12	\$	8	88	- س	9.0	8	2	0.08	52	\$17.49	(\$0.52)	\$16.97	\$204	\$243	0.84	14.32
117-1	Services & Support	£	∞	œ	F40T12	Q	8	88	₋	9.0	8	5	90:0	52	\$17.49	(\$0.52)	\$16.97	\$204	\$243	0.84	14.32
117-1	Services & Support	12	∞	œ	F40T12	Ş	2 8	88	2	9.0	8	2	0.35	1,048	\$81.64	(\$2.45)	\$79.19	\$852	\$1,134	0.84	14.32
117-1	Services & Support	13	∞	œ	F40T12	\$	8	8	m	9.0	8	£	90:0	23	\$17.49	(\$0.52)	\$16.97	\$204	\$243	9.8	14.32
117-1	Services & Support	7	∞	œ	F40T12	\$	8	88	2	9.0	8	£	0.30	888	\$69.88	(\$2.10)	\$67.88	\$816	\$972	0.84	14.32
117.1	Services & Support	5	∞	œ	F40T12	\$	8	8	6	9.0	8	2	90.0	83	\$17.49	(\$0.52)	\$16.97	\$204	\$243	0.84	14.32
117-1	Services & Support	9	-	œ	F40T12	\$	8	88	-	8.0	8	2	0.03	\$	\$6.92	(\$0.17)	\$6.75	\$ 81	\$81	9.	12.00
117-1	Services & Support	11	80	æ	F40T12	\$	2	8	-	9.0	8	2	0.03	æ	\$5.83	(\$0.17)	\$5.66	\$68	\$81	0.84	14.32
117-1	Services & Support	ю	-	œ	F40T12	4	8	8	-	8.0	8	2	0.03	\$	\$6.92	(\$0.17)	\$6.75	\$ 81	\$8	1.00	12.00
117-1	Services & Support	8	-	œ	F40T12	\$	2	8	-	9.0	8	5	0.03	\$	\$6.92	(\$0.17)	\$6.75	\$81	\$81	1.0	12.00
117-1	Services & Support	22	5	œ	F40T12	8	8	8	-	1.0	72	2	0.03	6	\$3.24	(\$0.02)	\$3.22	830	\$81	0.48	25.18
117-1	Services & Support	8 2	-	œ	F40T12	8	8	28	-	8.0	*	2	0.03	\$	\$6.82	(\$0.17)	\$6.75	\$ 81	\$	1.00	12.00
117-1	Services & Support	83	2	<u>د</u>	F40T12	ş	2	8	-	0.7	8	5	0.03	81	\$6.38	(\$0.17)	\$6.20	\$75	\$8	0.92	13.06
117-1	Services & Support	33	5	œ	F40T12	Q	2	8	-	0.7	*	2	0.03	87	\$6.38	(\$0.17)	\$6.20	\$75	\$8	0.92	13.06
117-1	Services & Support	ន	7	ω	F40T12	ş	2	8	4	0.7	8	2	0.10	349	\$25.51	(\$0.70)	\$24.81	\$298	\$324	0.92	13.06
117-1	Services & Support	8	5	ω L	F40T12	9	8	8	8	0.7	88	2	9.05	175	\$12.75	(\$0.35)	\$12.41	\$149	\$162	0.82	13.06
117:1	Services & Support	જ્ઞ	2	ω L	F40T12	4	2	8	8	0.7	8	5	90.0	175	\$12.75	(\$0.35)	\$12.41	\$149	\$162	0.92	13.06
117-1	Services & Support	8	12	ς, L	F40T12	4	2	28	4	0.7	8	5	0.10	340	\$25.51	(\$0.70)	\$24.81	\$298	\$324	0.82	13.06
117-1	Services & Support	28.3	2	S	F40T12	4	8	9 8	7	1.0	8	5	0.05	220	\$16.03	(\$0.35)	\$15.68	\$189	\$162	1.18	10.33
117-1	Services & Support	Exterior	Đ.	ς,	F40T12	4	2	8	7	1.0	2	2	0.06	218	\$14.67	(\$0.31)	\$14.36	\$173	\$162	1.07	11.28
117.3	Decontam & Small Parts	Inert Storage	7	•	F40T12	\$	2	 8	33	9.0	8	5	0.80	3,185	\$221.55	(\$5.50)	\$215.96	\$2,596	\$2,591	9.1	12.00
117-5	Refining Building	Toilet - Mens'	60	ς, L	F40T12	4	8	8	6	9.0	8	5	90.08	8	\$17.49	(\$0.52)	\$16.97	\$204	\$243	0.84	14.32
117-5	Refining Building	Corridor	-	ω L	F40T12	Q	2	88	-	0.7	8	5	9.03	87	\$6.38	(\$0.17)	\$6.20	\$75	\$81	0.92	13.06
117-5	Refining Building	Tollet - Womens'	∞	ω	F40T12	Q	8	88	7	9.0	8	2	90.0	051	\$11.06	(\$0.35)	\$11.31	\$136	\$162	9.8	14.32

Table H-5 Lighting Retrofits LF-3A AND LF-3B: Retrofit Electronic Ballasts and F32T8 Lamps in Existing 2-Lamp F40T12 2-Lamp Standard and Industrial Type Fixtures

Building Number	Building Name	Room No / Name	Task Type Code Code		Lamp	Lamp Watts/ Lamp/ Type Lamp Fixture		Watts/ Fixture	No of Fixtures	Demand Factor	Fixture (Hr/W/k)	Watts/ECO Fixture	Demand Saved (kW)	Use Saved (KWH/Yr)	Energy (\$/Y1)	O&M Saved (\$/Y1)	Total Saved (\$/Yr)	Total LCC\$ Saved	Invest- ment (5)	쫎	Payback (Years)
117.5	Refining Building	Lounge - Women's	8	Ø	F40T12	\$	2	8	-	9.0	8	19	0.03	75	\$5.83	(\$0.17)	\$5.86	\$68	283	0.84	14.32
117-6	Steamout Building	Mechanics Brk, Room	17	۵	F40T12	40	2	88	8	8.0	88	5	08:0	3,594	\$249.24	(\$6.29)	\$242.95	\$2,821	\$2,915	8.	12.00
Totals for	Totals for ECO LF-3A: Standard Fixtures	\$							187				4.68	18,592	\$1,291	(\$32.48)	\$1,258.80	\$15,133	\$15,144	1.00	12.03
Building Number	Building Name	Room No / Name	Task Type Code Code		Lamp	Watts/ Lamp/ Lamp Fixture		Watts/ Foture	No of Fixtures	Demand Factor	Fixture (Hr/WK)	Watts/ECO Fixture	Demand Saved (kW)	Use Saved (KWH/Yr)	Energy (\$/Y1)	O&M Saved (\$/Y)	Total Saved (\$/Yr)	Total LCC\$ Saved	Invest- ment (\$)	쫎	Payback (Years)
117-1	Services & Support	31	₽	P-Ind	F40T12	Q	7	88	-	1.0	12	61	0.03	91	\$3.24	(\$0.02)	\$3.22	ec \$	<i>11</i> \$	0.50	23.93
117.1	Services & Support	30, Mech	ŧ	P-Ind	F40T12	4	7	8	•	1.0	4	2	0.23	47	\$25.04	(\$0.05)	\$25.00	\$300	\$684	0.43	27.75
117-2	Boiler Building	Basement- Wtr Tritmnt	7	P	F40T12	4	8	88	ន	0.6	54	20	0.58	431	\$77.61	(\$0.75)	\$76.86	\$924	\$1,773	0.52	23.06
117-2	Boiler Building	Basement- Open Area	7	P-Ind	F40T12	4	8	28	6	9.0	75	2	0.48	356	\$64.11	(\$0.62)	\$63.49	\$763	\$1,484	0.52	23.08
117-3	Decontam & Small Parts	Mechanical Room	5	Pind	F40T12	4	8	8	8	6.	54	19	1.40	1,747	\$219.53	(\$1.82)	\$217.72	\$2,617	\$4,318	0.61	19.83
117-4	Bulk Explosives Disposal	UG Mech Room	5	P-ind	F40T12	\$	8	8	ಕ	0,1	75	19	0.85	1,061	\$133.29	(\$1.10)	\$132.18	\$1,589	\$2,621	0.61	19.83
117-5	Refining Building	Mechanical Room	5	P-Ind	F40T12	₽	8	8	Q	9.0	8	5	1.00	3,994	\$276.94	(\$5.19)	\$271.75	\$3,267	\$3,083	8.	11.35
117-6	Steamout Building	Mechanical Room North	15	P-Ind	F40T12	\$	8	8	42	8.0	8	5	1.05	4,183	\$290.79	(\$5.45)	\$285.33	\$3,430	\$3,237	1.08	11.35
117-6A	Pump Building	Pumpe	2	P-Ind	F40T12	\$	8	8	9	9.0	88	2	0.25	749	\$58.31	(\$1.30)	\$57.02	\$685	\$77	0.89	13.52
117.7	Water Treatment	Basement Pump Room	7	P-frd	F40T12	4	7	28	5	9.0	8	2	0.25	1,310	\$82.89	(\$2.27)	\$80.61	888	\$774	5 .	9.58
117-8	Mech. Removal Building	Mechanical Room	5	P-Ind	F40T12	\$	8	8	я	9.0	8	5	0.63	2,496	\$173.09	(\$3.24)	\$169.84	\$2,042	\$1,927	1.08	11.35
117-10	Preparation Building	Mechanical Room	ŧ	P-Ind	P-Ind F40T12	\$	7	8	88	0.8	8	61	1.38	5,491	\$380.79	(\$7.14)	\$373.65	\$4,492	\$4,239	9.	11.35
Totals for	Totals for ECO LF-3B: Industrial Fixtures	58.							324				8.10	21,890	\$1,786	(\$28.94)	\$1,757	\$21,118	\$24,973	0.85	14.22

LF-3A: Retrofit Electronic Ballast & 2 x F32T8 Lampe in Existing Standard 2-Lamp F40T12 Fixtures LF-38: Retrofit Electronic Ballast & 2 x F32T8 Lampe in Existing Industrial 2-Lamp F40T12 Fixtures

Table H-6 Lighting Retrofit LF-4A and LF-4B: Retrofit 4-Lamp F40T12 Fixtures either with 4 x F32T8 Lamps and Electronic Ballast or Retrofit Reflector and Delamp to 2 x F32T8 Lamps and Electronic Ballast

Building	Building Name	Room No / Task Type Name Code Code	Task Code (Lamp W Type L	Watts/ Lamp/ Lamp Fixture		Watts/ N Fixture Fix	No of De Fixtures F	Demand 1 Factor (Fixture (Hr/Wk)	Watts/ECO Fixture	Demand Saved (kW)	Use Saved (KWH/Yr)	Energy (\$/Y1)	O&M Saved (\$/Yt)	Total Saved (\$/Yr)	Total LCC\$ Saved	Invest- ment (\$)	쫎	Payback (Years)
117-1	Services & Support	S.	18	œ	F40T12	9	4	172	16	1.0	8	122	0.80	3,994	\$256.50	(\$4.79)	\$251.71	\$3,026	\$2,488	1.23	9.80
117:1	Services & Support	8	•	œ	F40T12	Q	4	172	8	0.7	8	22	0.10	348	\$25.51	(\$0.80)	\$24.91	\$288	\$308	0.97	12.38
117-1	Services & Support	19	4	<u>~</u>	F40T12	\$	-	221	7	0.7	8	122	0.10	349	\$25.51	(\$0.60)	\$24.91	\$288	\$308	0.97	12.38
117-1	Services & Support	8	4	œ	F40T12	Q	4	22	15	0.7	8	<u> </u>	0.75	2,621	\$191.32	(\$4.49)	\$186.84	\$2,246	\$2,312	0.97	12.38
117-3	Decontam & Small Parts	Supervisor Office	•	<u>~</u>	F40T12	₽	4	172	0	0.7	8	21	0.45	1,572	\$114.79	(\$2.69)	\$112.10	\$1,348	\$1,387	0.97	12.38
117-3	Decontam & Small Parts	Corridor	-	s S	F40T12	\$	4	221	7	0.1	8	27	0.10	490	\$32.08	(\$0.60)	\$31.46	\$378	\$308	2	9.80
117-3	Decontam & Small Parts	Men's W/C	∞	ű	F40T12	\$	-	172	8	9.0	8	<u> </u>	0.10	300	\$23.33	(\$0.60)	\$22.73	\$273	\$308	0.89	13.57
117-3	Decontam & Small Parts	Women's W/C	€	G	F40T12	\$	-	22	7	9.0	8	27	0.10	300	\$23.33	(\$0.60)	\$22.73	\$273	\$308	0.80	13.57
117-4	Bulk Explosives Disposal	UG Control Room	•	e c	F40T12	9	-	172	11	6 :	8	2	0.85	3,819	\$253.98	(\$2.08)	\$248.88	\$2,992	\$2,621	<u>+</u> :	10.53
117-4	Bulk Explosives Disposal	UG Toilet - Women	∞	v	F40T12	₽	4	172	8	9.0	8	22	0.10	8	\$23.33	(\$0.60)	\$22.73	\$273	\$308	0.89	13.57
117-4	Bulk Explosives Disposal	UG Comidor	-	S	F40T12	9	-	172	7	8.0	8	ā	0.10	300	\$27.69	(\$0.60)	\$27.10	\$326	\$308	9.0	11.38
1174	Bulk Explosives Disposal	UG Toilet - Men	€0	G	F40T12	\$	•	271	8	9.0	8	2	0.10	300	\$23.33	(20.60)	\$22.73	\$273	\$308	0.89	13.57
117-6	Steamout Building	Corridor	-	Ø	F40T12	₽	·-	22	4	9.0	8	<u>12</u>	0.20	286	\$46.65	(\$1.20)	\$45.45	\$546	\$617	0.89	13.57
117-6	Steamout Building	ŝ	₽	œ	F40T12	Q	-	172	7	0.7	8	<u>\$</u>	0.35	1,223	\$89.28	(\$2.08)	\$87.19	\$1,048	\$1,079	0.97	12.38
117.7	Water Treatment	Control Rm	4	Ø	F40T12	\$	-	172	ĸ	1.0	991	苕	0.25	2,184	\$121.11	(\$2.62)	\$118.49	\$1,424	\$77	1.85	6.50
117-8	Mech. Removal Building	Supervisor's Office	•	œ	F40T12	\$	•	271	8	8.0	8	苕	0.10	300	\$27.69	(\$0.60)	\$27.10	\$326	\$308	8.	11.38
117-8	Mech. Removal Building	Corridor	-	Ø	F40T12	\$	₹	172	7	9.0	8	22	0.10	300	\$23.33	(\$0.60)	\$22.73	\$273	\$308	0.89	13.57
117-10	Preparation Building	Corridor	-	œ	F40T12	4	4	221	2	2.0	8	122	0.10	349	\$25.51	(\$0.60)	\$24.91	\$286	\$308	0.97	12.38
117-10	Preparation Building	Control Rm	4	œ	F40T12	8	+	172	5	9.0	8	<u>\$</u>	0.75	2,985	\$207.70	(\$4.49)	\$203.22	\$2,443	\$2,312	1.08	11.38
117-10	Preparation Building	Supervisor's Office	4	œ	F40T12	₽ ₽		172	8	8.0	8	122	0.40	1,597	\$110.78	(\$2.39)	\$108.38	\$1,303	\$1,233	1.08	11.38
Totals for	Totals for ECO LF-4A								118				2:30	24,448	\$1,673	(\$36.42)	\$1,636.29	\$19,671	\$18,190	1.08	11.12

Building Number	Building Building Name	Room No / Task Type Lamp Name Code Code Type	Task Code	Type Code	Lamp	Watts/ Lamp/ Lamp Fixture	Lemp/ Fixture	Watts/ Fixture	No of Fixtures	Demand Factor	Fbture (HrAVK)	Watts/ECO Fbture	Demand Saved (kW)	Use Saved E	Energy (\$/Yr)	O&M Saved (\$/Yt)	O&M Saved Total Saved Total LCC\$ (\$YY) (\$YY) Saved	Total LCC\$ Saved	Invest- ment (S)	쭚	Payback (Years)
117-1	117-1 Services & Support	S	81	æ	18 R F40T12 40	\$	4	172	18	1.0	8	2	1.78	8,866	\$569.42	\$48.80	\$618.23	\$7,427	\$1,346 5.52	5.52	2.18
117-1	117-1 Services & Support	6 0	•	œ	4 R F40T12 40	\$	•	172	8	0.7	8	5	0.22	776	\$56.63	\$6.10	\$62.73	\$754	\$168	4.48	2.68
117-1	117-1 Services & Support	6	•	œ	R F40T12	₽	•	12	8	0.7	8	5	0.22	7,6	\$56.63	\$6.10	\$62.73	\$754	\$168	4.48	2.68
117-1	117-1 Services & Support	8	4	œ	F40T12	₽	•	172	51	0.7	8	£	1.67	5,818	\$424.74	\$45.75	\$470.49	\$5,062	\$1,282	4.	2.68

Table H-6 Lighting Retrofit LF-4A and LF-4B: Retrofit 4-Lamp F40T12 Fixtures either with 4 x F32T8 Lamps and Electronic Ballast or Retrofit Reflector and Delamp to 2 x F32T8 Lamps and Electronic Ballast

Building Number	Building Name	Room No / Task Type Name Code Code	Task Type Code Code	Type	Lamp Type	Watts/ Lamp/ Lamp Fixture		Watts/ Fixture	No of I	Demand Factor	Fixture (Hr/WK)	Watts/ECO Fixture	Demand Saved (kW)	Use Saved (kWH/Yr)	Energy (\$/Yr)	O&M Saved (\$/Yr)	Total Saved (\$/Yr)	Total LCC\$	Invest- ment (5)	쭚	Payback (Years)
117.3	Decontam & Small Parts	Supervisor Office	4	œ	F40T12	\$	-	172	۵	0.7	8	20	1.00	3,491	\$254.84	\$27.45	\$282.29	\$3,391	\$757	4.48	2.68
117-3	Decontam & Small Parts	Солідог	-	ဟ	F40T12	4	•	172	7	0.1	88	6	0.22	1,108	\$71.18	\$6.10	\$77.28	\$928	\$168	5.52	2.18
117-3	Decontam & Small Parts	Men's W/C	80	Ø	F40T12	4	4	172	7	9.0	88	2	0.22	985	\$51.78	\$6.10	\$57.88	\$695	\$168	4.13	2.91
117-3	Decontam & Small Parts	Women's W/C	∞	Ø	F40T12	Q	4	172	7	9.0	88	19	0.22	985	\$51.78	\$6.10	\$57.88	\$685	\$168	4.13	2.81
117-4	Bulk Explosives Disposal	UG Control Room	4	œ	F40T12	\$	4	172	11	6.0	8	2	1.89	8,478	\$563.80	\$51.86	\$615.65	\$7,396	\$1,430	5.17	2.32
117-4	Bulk Explosives Disposal	UG Toilet - Women	∞	Ø	F40T12	\$	4	172	7	9.0	88	6	0.22	965	\$51.78	\$6.10	\$57.88	\$665	\$168	4.13	2.91
117-4	Bulk Explosives Disposal	UG Corridor	-	Ø	F40T12	4	4	172	7	8.0	8	2	0.22	887	\$61.48	\$6.10	\$67.58	\$812	\$168	8	2.48
117-4	Bulk Explosives Disposal	UG Tollet - Men	∞	Ø	F40T12	\$	4	172	8	9.0	8	25	0.22	888	\$51.78	\$6.10	\$57.88	\$695	\$168	4.13	2.91
117-8	Steamout Building	Corridor	-	w	F40T12	\$	4	172	4	9.0	88	5	0.44	1,330	\$103.57	\$12.20	\$115.77	\$1,391	\$338	4.13	2.81
117-8	Steamout Building	ŝ	₽	œ	F40T12	\$	4	172	7	0.7	88	5	0.78	2,715	\$198.21	\$21.35	\$219.58	\$2,637	\$588	4.48	2.68
117-7	Water Treatment	Control Rm	•	Ø	F40T12	\$	4	172	£0	0,	5	2	0.58	4,848	\$268.86	\$26.69	\$285.55	\$3,550	\$421	8.44	1.42
117-8	Mech. Removal Building	Supervisor's Office	•	œ	F40T12	\$	•	172	6	8.0	8	5	0.22	788	\$61.48	\$6.10	\$67.58	\$812	\$168	83.	2.48
117-8	Mech. Removal Building	Corridor	-	Ø	F40T12	\$	4	172	7	9.0	88	5	0.22	965	\$51.78	\$6.10	\$57.88	\$685	\$168	4.13	2.91
117-10	Preparation Building	Corridor	-	œ	F40T12	\$	4	172	8	0.7	88	5	0.22	977	\$58.63	\$6.10	\$62.73	\$754	\$168	4.48	2.68
117-10	Preparation Building	Control Rm	4	α	F40T12	\$	•	172	ŧ	9.0	88	5	1.67	6,649	\$461.10	\$45.75	\$506.86	\$6,089	\$1,262	4.83	2.49
117-10	Preparation Building	Supervisor's Office	4	œ	F40T12	\$	4	172	8	8.0	8	16	0.89	3,548	\$245.92	\$24.40	\$270.32	\$3,247	\$673	83.	2.49
Totals for	Totals for ECO LF-4B								118				13.10	54,275	\$3,713	\$371.38	\$4,084.78	\$49,089	\$9,925	8	2.43

LF4A: Retrofit Electronic Ballasta & 4 x F3278 Lampa in Existing 4-Lamp F40712 Fixtures, or LF4B: Retrofit Reflector and Delamp Existing 4-Lamp F40712 Fixtures to 2 x F3278 Lamps with Electronic Ballasts

Table H-7 Lighting Retrofit LF-5: Modify 100 Watt Incandescent Fixtures for DTT-26 Watt Compact Fluorescent Lamps

Building Number	Building Building Name	Room No / Task Type Lamp Watts/ Lamp/ Name Code Code Type Lamp Fixture	Task Code	7. 00 8	Lamp Type	Watts/ Lamp		Watts/ Fixture	No of Fixtures	No of Demand Fixtures Factor	Fixture (Hr/Wk)	Watts/ECO Fixture	Demand Use Saved Energy O&M Saved Saved (kW) (kWHYr) (\$Yr) (\$Yr)	Use Saved (KWH/Yr)	Energy (\$/Yr)	O&M Saved (\$/Yr)	Total Saved Total LCC\$ Invest- (\$/Y1) Saved ment (\$)	Total LCC\$ Saved	Invest- ment (5)	SiR	Payback (Years)
117-3	117-3 Decontam & Small Parts	Janitor's Closet	16 S	w	100	5	-	100	-	1.0	80	36	0.07	22	\$7.83	\$1.25	\$9.08	\$108	\$51	2.12	5.67
117-4	117-4 Bulk Explosives Disposal	AG Roof	7	P.Ö	-	8	-	8	4	1.0	8	88	0.26	1,298	\$83.36	\$60.16	\$143.53	\$1,720	\$206	8.38	1.43
117.4	117-4 Bulk Explosives Disposal	UG Janitor Closet	6	တ	- 0	8	-	8	-	0.	80	જ	0.07	22	\$7.83	\$1.25	\$9.08	\$109	\$51	2.12	5.67
117-5	117-5 Refining Building	Janitor's Closet	16 S I 100	Ø	-	<u>8</u>	-	100	-	1.0	12	35	0.07	41	\$8.42	\$1.88	\$10.30	\$124	\$51	2.40	5.00
Totals for	Totals for ECO LF-5								8				0.39	1,366	\$99.61	\$63.30	\$162.90	\$1,953	\$300	6.33	1.80

Table H-8 Lighting Retrofit LF-6: Modify 150 Watt Incandescent Fixtures for DTT-26 Watt Compact Fluorescent Lamps

Building Number	Building Building Name	Room No / Task Type Lamp Watts/ Lamp/ Name Code Code Type Lamp Fixture	Task Code	Type Code	Lamp Type	Watts/ Lamp	Lamp/ Fixture	Watts/ Fixture	No of Fixtures	Demand	Fixture (Hr/Wk)	Watts/ECO Fixture	Watts/ECO Demand Use Saved Energy (Fixture Saved (kW) (kWH/Yr) (\$7Yr)	Use Saved (KWH/Yr)	Energy (\$/Yr)	y O&M Saved Total Saved Total LCC\$ Invest- R	Total Saved (\$/Yr)	Total LCC\$	Invest- ment (S)	쭚	Payback (Years)
117-8	117-6 Steamout Building	Janitor's Closet	8 5	16 S I 150	_	55	-	150	-	0.	12	35	0.12	22	\$14.89	\$1.88	\$16.77	\$201	\$51 3.81	3.94	3.07
117-8	117-8 Mech. Removal Building	Jan Closet 16 S	91	ω	150	55	-	150	-	1.0	5	35	0.12	22	\$14.89	\$1.88	\$16.77	\$201	\$51	3.91	3.07
117-10	117-10 Preparation Building	Janitor's Closet	5	16 S I 150	-	150	-	150	-	1.0	12	ક્ષ	0.12	22	\$14.89	\$1.88	\$18.77	\$201	\$51	3.91	3.07
Totals for	otals for ECO LF-6								၉				0.35	215	\$44.68	\$5.64	\$50.32	\$604	\$154 3.91	3.91	3.07

Table H-9 Lighting Retrofit LF-7: Retrofit Existing 175 Watt Mercury Vapor Fixtures with 50 Watt High Pressure Sodium Lamps and Ballasts

Building Number	Building Name	Room No / Task Type Lemp Watts/ Lamp/ Name Code Code Type Lemp Foture	Task Code	Task Type Lamp Watts/ Code Code Type Lamp	Jype I	Vatts/ Lu		Watts/ I Fixture Fi	No of D Fixtures	Demand Factor (Fixture (Hr/Wk)	Watts/ECO Fixture	Demand Saved (KW)	Use Saved (KWH/Yr)	Energy (\$/Yr)	O&M Seved Total Seved Total LCC\$ (\$\mathcal{S}\tau^2\) (\$\mathcal{S}\tau^2\) Saved	Total Saved (\$/Yr)	Total LCC\$	Invest- ment (5)	쭚	Payback (Years)
117-1	Services & Support	Exterior	Ed	တ	M	175	-	198	4	1.0	2	80	0.47	2,062	\$138.45	(\$7.56)	\$130.88	\$1,574	\$724	2.17	5.53
117-2	Boiler Building	Exterior	ğ	w	≩	175	-	88	8	0.	2	8	2.36	10,308	\$692.23	(\$37.82)	\$854.41	\$7,869	\$3,622	2.17	5.53
117-3	Decontam & Small Parts	Exterior	EST.	w	≩	175	-	198	5	1.0	2	8	5.07	22,163	\$1,488	(\$81.31)	\$1,406.99	\$16,919	\$7,787	2.17	5.53
117.4	Bulk Explosives Disposal	Exterior		Ø	≩	175	-	88	m	0.	2	8	0.35	1,546	\$103.84	(\$5.67)	\$98.16	\$1,180	\$543	2.17	5.53
117-4	Bulk Explosives Disposal	Exterior	EX	တ	≩	175	-	88	8	1.0	\$	8	0.24	1,031	\$69.22	(\$3.78)	\$65.44	\$787	\$362	2.17	5.53
117-5	Refining Building	Exterior	ğ	Ø	≩	175	-	88	\$	1.0	3	8	1.89	8,247	\$553.79	(\$30.26)	\$523.53	\$6,285	\$2,898	2.17	5.53
117-8	Steamout Building	Exterior		Ø	¥	175	-	8	ŧ.	0.1	2	8	1.71	7,731	\$519.18	(\$28.36)	\$490.81	\$5,902	\$2,718	2.17	5.53
117-6A	Pump Bullding	Exterior	ğ	Ø	¥	175	-	88	6	0.1	2	8	0.35	1,546	\$103.84	(\$5.67)	\$98.16	\$1,180	\$543	2.17	5.53
117-7	Water Treatment	Exterior	ğ	Ø	≩	175	-	88	vo.	0.1	2	8	0.59	2,577	\$173.08	(\$8.45)	\$163.60	\$1,967	\$905	2.17	5.53
117-8	Mech. Removal Building	Exterior	E C	Ø	≩	175	-	88	65	1.0	2	8	1.06	4,639	\$311.51	(\$17.02)	\$284.49	\$3,541	\$1,630	2.17	5.53
117-10	Preparation Building	Exterior	ES ES	v	¥	175	-	8 8	5	1.0	æ	8	1.77	7,731	\$519.18	(\$28.36)	\$490.81	\$5,902	\$2,716	2.17	5.53
117-11	117-11 Accumulator Building	Exterior	E E	S	≩	175	-	188	ေ	1.0	Z	80	0.35	1,546	\$103.84	(\$5.67)	\$98.18	\$1,180	\$543	2.17	5.53
Totals for ECO LF-7	ECO LF.7								138				16.28	71,129	\$4,776	(\$260.96)	\$4,515.46	\$54,297	\$24,991	2.17	5.53

Table H-10 Lighting Retrofit LF-8: Retrofit Existing 400 Watt Metal Halide Fixtures with 250 Watt High Pressure Sodium Lamps and Ballasts

Building	:	Room No /	Task	1	e me	Watts/	/ama/	Watts/	Š S	Demand	Fireture	Watts/FCO	- Damand	ben Saved	T ST	O.S. Saved	O&M Savad Total Savad Total I CC	Total	1		doctor!
Number	Number Building Name	Name Code Code Type Lamp Fixture	စီ	g C C	Type	Lamp	Fixture	- 1	Fixtures	Factor		Fixture	Saved (kW)	(kWH/Yr)		(\$/Yr)	(\$/Vt)	Saved	ment (5)	쫎	(Years)
117-4	117-4 Bulk Explosives Disposal	AG Cell 14 P-ExP MH 400	41	P-ExP	¥	400	-	460	80	1.0	8	300	1.28	086,8	\$410.40	\$24.49	\$434.89	\$5,225	\$1,830	2.86	121
117-4	117-4 Bulk Explosives Disposal	AG Cell 2	7	14 P.E.P	₹	Q	-	460	60	1.0	8	300	1.28	6,390	\$410.40	\$24.49	\$434.89	\$5,225	\$1,830	2.86	4.21
117-5	Refining Building	Top Level Processing	4	P-EyP	¥	8	-	94	60	1.0	8	900	1.28	6,390	\$410.40	\$24.49	\$434.89	\$5,225	\$1,830	2.86	4 21
117-6	117-6 Steamout Building	South Tower	4	P.E.Po	₹	8	-	8	12	0.1	8	300	1.92	9,585	\$615.59	\$36.74	\$652.33	\$7,838	\$2,745	2.86	4.21
117-7	Water Treatment	Filher Room 14 P.ExP	4	P.ExP	Ĭ	Q	-	8	ø	9.0	\$	300	4.1	7,548	\$477.42	\$48.22	\$525.64	\$6,314	\$2,059	3.07	3.92
117.7	117.7 Water Treatment	Chem Tanks 14 P-ExP MH	14	P-EAP		400	-	460	၈	9.0	89	300	0.48	2,516	\$159.14	\$18.07	\$175.21	\$2,105	\$686	3.07	3.82
Totals for	Totals for ECO LF-8								84				7.68	38,818	\$2,483	\$174.52	\$2,657.86	\$31,934	\$10,980 2.91	291	4.13

F:VPROJ/1640316/ENGRILITE-ECO.XLS LC-1

Table H-11 Lighting Control Retrofit LC-1: Ceiling Mounted Passive Infrared (PIR) Motion Sensors

Building Number	Building Name	Room No / Name	ECO Included	Task Type Code Code		Lemp L Type Fi	Lamp/ W Fixture Fi	Watts/ P	No of De Fotures F	Demand I Factor (Fixture (Hr/WK)	Sensor Savings (%)	Number of Sensors	Use Saved (kWH/Yr)	Energy (\$/Yr)	O&M Saved (\$/Yt)	Total Saved (\$/Yr)	Total LCC\$ Saved	Invest- ment (5)	SiR	Payback (Years)
117.1	Services & Support	4	•	8	<u>α</u>	F40T12	2	98	12	1.0	8	20%	2	1,030	\$45.08	\$0.00	\$45.08	\$542	\$797	890	17.68
117-1	Services & Support	ĸ	LF-48	₽	<u>~</u>	F32T8	8	2	5	1.0	8	20%	၈	974	\$42.63	\$0.00	\$42.63	\$512	\$1,196	0.43	28.05
117-1	Services & Support	œ	•	17	œ	F40T12	8	8	8	0,1	8	30%	•	2,833	\$123.97	\$0.00	\$123.97	\$1,490	\$1,594	880	12.86
117-1	Services & Support	‡	•	•	œ	F40T12	8	8	12	9.0	8	35%	8	1,082	\$47.34	\$0.00	\$47.34	\$569	\$797	0.71	16.84
117-1	Services & Support	8	LF.48	•	~	F3ZTB	8	5	ŧ	0.7	8	30%	74	828	\$41.97	\$0.00	\$41.97	\$504	\$797	8	18.99
117-3	Decontam & Small Parts	Supervisor Office	LF-48	4	C	F32T8	8	2	•	0.7	8	30%	-	576	\$25.18	2 0.00	\$25.18	\$303	\$368	0.76	15.83
117-3	Decontam & Small Parts	Corridor	LF-48	-	S	F32T8	8	2	8	1.0	8	25%	8	152	\$6.88	\$0.00	\$6.68	280	\$797	0.10	119.67
117-4	Bulk Explosives Disposal	UG Corridor	LF-48	_	S S	F32T8	8	2	7	9.0	8	25%	-	2	\$5.33	\$0.00	\$5.33	28	\$388	9.16	74.79
117-5	Refining Building	Corridor		-	S	F40T12	8	8	-	0.7	8	25%	-	75	\$3.29	\$0.00	\$3.29	840	8388	0.10	121.28
117-6	Steamout Building	Corridor	LF-48	_	S	F3ZT8	8	5	•	9.0	8	25%	-	183	87.99	\$0.00	86.78	98\$	\$366	0.24	49.86
117-7	Water Treatment	Control Rm	LF-48	4	ø	F32T8	7	5	so.	0.1	\$	30%	-	788	\$34.87	\$0.00	\$34.97	\$420	\$388	8	11.40
117-8	Mech. Removal Building	Supervisor's Office	LF-48	4	œ	F32T8	8	2	8	8.0	8	30%	-	148	\$6.40	\$0.00	\$6.40	511	\$388	0.19	62.33
117-8	Mech. Removal Building	Corridor	LF-48	-	S	F3ZT8	8	£	7	9.0	8	25%	-	5	\$7	\$0.00	\$4.00	\$48	\$388	0.12	27.08
117-10	Preparation Building	Corridor	LF-48	•	œ	F3ZT8	7	5	8	0.7	8	25%	-	107	\$4.08	\$0.00	\$4.06	\$28	\$388	0.1	85.48
117-10	117-10 Preparation Building	Supervisor's Office	LF-48	4	e c	F32T8	7	19	80	0.8	8	30%	-	585	\$25.58	\$0.00	\$25.58	\$307	\$386	0.77	15.58
Totals for ECO LC-1	ECO LC-1												75	9,715	\$425	\$0.00	\$425.08	\$5,109	\$9,586	0.53	22.51

Ceiling Mounted PIR controls are suitable for conference nooms and larger open offices and other rooms.
Savings are assumed to be at the lower end, or below, savings ranges claimed by manufacturers of motion sensor controls, based on performance of actual installed systems.
Delamping and fature retrofit ECOs with SIRs above 1.0 are assumed implemented prior to evaluation of energy savings for lighting control retrofit ECOs. This avoids "double-counting" of energy savings.

Table H-12 Lighting Controls Retrofit LC-2: Celling Mounted Ultrasonic Motion Sensors

Bullding Number	Building Name	Room No / Name	ECO Task Included Code	Task Code	Task Type Code Code	Lamp Watta/ Type Lamp	Watts/ I	Lemp/ 1	Watts/ Fbture F	No of Flatures	Demand Factor (Fbture (Hr/WK)	Sensor Savings (%)	Number of Sensors	Use Saved (KWH/Yr)	Energy (\$/Yr)	O&M Saved (\$/YY)	Total Saved	Total LCC\$	Invest- ment (S)	쭚	Payback (Years)
Ø	Services & Support	13		8	~	F40T12	ş	7	88	۳	9.6	88	36%	-	270	\$11.83	\$0.00	\$11.83		882	0.38	33.68
Ø	Services & Support	ŧ		∞	œ	F40T12	\$	7	88	m	9:0	88	36%	-	270	\$11.83	\$0.00	\$11.83	\$142	\$399	9.36	33.68
w	Services & Support	á		-	œ	F40T12	\$	8	88	-	9.0	88	25%	-	8	\$3.76	8 0.00	\$3.76	3	\$399	0.1	106.10
w	Services & Support	11		••	œ	F40T12	\$	8	8	-	9.6	88	36%		8	\$3.94	\$0.00	\$3.94	\$	\$399	0.12	101.05
0	Decontam & Small Parts	Men's W/C	F.	•	Ø	F32T8	32	7	5	7	9.0	8	36%	-	128	\$5.60	\$0.00	\$5.80	19\$	\$399	0.17	71.23
u	Decontam & Small Parts	Women's W/C	LF-48	••	တ	F3ZT8	33	8	2	~	9.0	8	3636	-	128	\$5.60	\$0.00	\$5.60	295	6683	0.17	71.23
ш	Bulk Explosives Disposal	UG Tollet - Women	F-48	€0	တ	F3ZT8	33	8	6	8	9.0	8	36%	-	128	\$5.60	\$0.00	\$5.60	292	8388	0.17	71.23
ш	Bulk Explosives Disposal	UG Tollet - Men	F.	•	ဟ	F3ZTB	32	8	5	8	9.0	88	32%	-	128	\$5.60	\$0.00	\$5.60	267	\$399	0.17	71.23
IE.	Refining Building	Tollet - Mens'		€0	Ø	F40T12	\$	8	88	m	9.0	8	35%	•	270	\$11.83	\$0.00	\$11.83	\$142	\$399	98.0	33.68
œ	Refining Building	Tollet - Womens'		•0	Ø	F40T12	\$	8	8	8	9.0	8	35%	-	8	\$7.89	\$0.00	\$7.89	963	\$399	0.24	50.52
(A)	Steamout Building	Tollet - Mens'	707	••	Ø	F32T8	32	8	2	8	9.0	88	36%	-	128	\$5.60	\$0.00	\$5.60	267	\$399	0.17	71.23
က	Steamout Building	Tollet - Womens'	rD-2	•••	တ	F32T8	32	8	5	8	9.0	8	35%	-	128	8.8	\$0.00	\$5.80	\$ 67	\$399	0.17	71.23
w	Steamout Building	Leb	F-48	€	œ	F32T8	33	8	19	7	0.7	*	35%	-	225	\$22.85	\$0.00	\$22.85	\$275	\$399	0.68	17.44
	Mech. Removal Building	Men's W/C	10-7	•	ω	F3ZT8	32	2	2	8	9.0	88	36%	-	128	\$5.60	80.00	\$5.60	267	\$399	0.17	71.23
	Mech. Removal Building	Women's W/C	707	•0	Ø	F32T8	32	8	2	2	9.0	*	36%	-	128	82.60	80.08	\$5.60	267	862	0.17	71.23
Ω.	Preparation Building	Women's W/C	10-2	••	œ	F3ZT8	32	8	5	8	9.0	8	36%	-	128	\$5.60	\$0.08	\$5.60	293	\$399	0.17	71.23
- 6 ■	Preparation Building	Men's W/C	rp-2	•	œ	F32T8	32	2	5	8	9.0	*	36%	-	128	\$5.60	\$0.00	\$5.60	19\$	868	0.17	71.23
(1)	Totals for ECO LC-2													17	2,969	\$130	\$0.00	\$129.90	\$1,561	\$6,776	0.23	52.16

Controls for tollet and bethrooms and other spaces with pertitions or other sight-line-obscuring features must be able to "see" over and around them. Ultrasonic motion sensors provide this service. Savings are assumed to be at the lower end, or below, savings ranges claimed by manufacturers of motion sensor controls, based on performance of actual installed systems.
Delamping and future retroft ECOs with SIRs above 1.0 are assumed implemented prior to evaluation of energy savings for lighting control retroft ECOs. This avoids "double-counting" of energy savings.

F. PROA1640316/ENGRILITE-ECO.XLS LC-2

Table H-13 Lighting Controls Retrofit LC-3: Passive Infrared (PIR) Motion Sensor / Wall Switches

Building Number	Building Name	Room No / Name	ECO Included	Code K		Lamp V Type L	Watts/ L	Lamp/ W Fbture Ft	Watts/ N Fbture Fb	No of Pattures F	Demand F Factor (1	Fixture (Hr/WK)	Sensor Savings (%)	Number of Sensors	Use Saved (KWH/Yr)	Energy (\$/Yr)	O&M Saved (\$/Yr)	Total Saved Total LCC\$ (\$YY) Saved	Total LCC\$ Saved	Invest- ment (\$)	SIR	Payback (Years)
117-1	Services & Support	-	10-2	•	œ	F3ZT8	32	7	5	4	0.7	8	30%	-	528	\$11.19	\$0.00	\$11.19	\$135	\$119	1.13	10.67
147-1	Services & Support	•	•	8	œ	F40T12	\$	2	88	•	0.1	8	30%	-	515	\$22.54	80.00	\$22.64	1.72\$	\$119	2.27	5.30
117-1	Services & Support	7	٠	8	œ	F40T12	\$	2	88	12	0.1	8	30%	-	1,546	\$67.62	\$0.00	\$67.62	\$813	\$118	6.81	1.71
117-1	Services & Support	\$	LF.48	•	œ	F32T8	æ	8	5	8	0.7	8	30%	-	128	\$5.80	\$0.00	\$5.60	29\$	\$119	99.0	21.34
117-1	Services & Support	6	LF.48	•	œ	F3ZTB	33	8	5	8	0.7	8	30%	-	128	\$5.60	\$0.00	\$5.60	201	\$119	99.0	21.34
117-1	Services & Support	8		-	~	F40T12	\$	8	8	-	8.0	88	25%	-	88	\$3.76	\$0.00	\$3.76	3	\$119	0.38	31.78
117-1	Services & Support	8	٠	2	œ	F40T12	\$	8	. 22	-	0.7	88	40%	-	52	\$5.26	\$0.00	\$5.26	8	\$119	0.53	22.70
117-1	Services & Support	ន	•	2	w	F40T12	\$	8	8	4	0.7	88	40%	-	£8.	\$21.04	\$0.00	\$21.04	\$263	\$119	2.12	5.68
117-1	Services & Support	*	•	5	ω	F40T12	\$	8	8	8	0.7	88	4 0%	-	240	\$10.52	\$0.00	\$10.52	\$126	\$119	9.	11.35
117-1	Services & Support	x	•	5	ω	F40T12	\$	~	28	8	0.7	8	40%	-	240	\$10.52	\$0.00	\$10.52	\$126	\$119	8	11.35
117-1	Services & Support	8	•	12	ω	F40T12	\$	8	8	•	0.7	88	40%	-	481	\$21.04	80.08	\$21.04	\$253	\$119	2.12	99.9
117-1	Services & Support	28.3	•	\$	ø	F40T12	\$	8	88	8	0.	8	30%	7	528	\$11.27	\$0.00	\$11.27	\$135	823	0.57	21.19
117-3	Decontam & Small Parts	Women's Lounge	79	••	Ø	F32T8	32	8	19	-	9.0	*	36%	-	2	\$2.80	\$0.00	\$2.80	ē	\$119	0.28	42.68
117-4	Bulk Explosives Disposal	Women's Lounge	10-2	€0	w	F32T8	33	8	5	-	9.0	8	35%	-	2	\$2.80	\$0.00	\$2.80	Z	\$ 119	0.28	42.68
117-6	Refining Building	Lounge -	•	••	ω	F40T12	\$	8	8	-	9.0	8	35%	-	8	\$3.94	\$0.00	\$3.94	7	\$119	0.40	30.27
117-6	Steamout Building	Womens' Lounge	707	•0	w	F32T8	32	8	2	-	9.0	8	35%	-	2	\$2.80	80.08	\$2.80	23	\$118	0.28	42.68
117-8	Mech. Removal Building	Women's Lounge	2	••	ø	F3ZTB	33	8	2	-	9.0	*	35%	-	2	\$2.80	\$0.00	\$2.80	25	\$119	0.28	42.68
117-10	Preparation Building	Women's Lounge	7	••	œ	F32T8	32	2	19	-	9.6	88	36%	1	2	\$2.80	\$0.00	\$2.80	753	\$118	0.28	42.68
Totals for ECO LC-3	ECO LC-3													19	4,888	\$214	\$0.00	\$213.88	\$2,571	\$2,269	1.13	10.61

Wall mounted PIR motion sensors replace existing wall toggle switches in small offices and other spaces.
Savings are assumed to be at the lower end, or below, savings ranges claimed by manufacturers of motion sensor controls, based on performance of actual installed systems.
Delamping and facture retroff ECDs with SIRs above 1.0 are assumed implemented prior to evaluation of energy savings for lighting control retroff ECDs. This avoids "double-counting" of energy savings.

Table H-14. Energy Use and Operating Costs of Existing Lighting Fixtures

Existing Fixture Type Description	Watts per Fixture	Lamp Life (Hours)	Lamp Cost (\$ Each)	Labor (Hr/Lamp)	Cost/1,000	Proposed Lighting Fixture Retrofits
Lighting Fixture Delamping with Lamp and Ballast Retrofits	Retrofits					
F40T12 - 2 Lamps per Fixture - Standard Fixture	86.0	20,000	\$2.75	0.150	\$0.363	LD-1: Delamp and Retrofit from 2-Lamp F40T12 Fixture to a 1-Lamp F32T8 Fixture with Electronic Ballast
F40T12 - 4 Lamps per Fixture - Standard Fixture	172.0	20,000	\$2.75	0.122	\$0.321	LD-2: Delamp and Retrofit from 4-Lamp F40T12 Fixture to a 2-Lamp F32T8 Fixture with Electronic Ballast
Lighting Fixture Lamp and/or Ballast Retrofits						
Exit Light: F-6W - 2 Lamps per Fixture	20.0	131,400	\$2.45	0.083	\$0.038	LF-1: Retrofit LED Lamp Kit in Existing Exit Lights
F40T12 - 1 Lamp per Fixture - Standard Fixture	50.0	20,000	\$2.75	0.167	\$0.388	LF-2: Retrofit Electronic Ballast & 1xF32T8 Lamp
F40T12 - 2 Lamps per Fixture - Standard Fixture	86.0	20,000	\$2.75	0.150	\$0.363	LF-3A: Retrofit Electronic Ballast & 2xF32T8 Lamps, Standard Fixture
F40T12 - 2 Lamps per Fixture - Industrial Fixture	86.0	20,000	\$2.75	0.100	\$0.288	LF-3B: Retrofit Electronic Ballast & 2xF32T8 Lamps, Industrial Fixture
F40T12 - 4 Lamps per Fixture - Standard Fixture	172.0	20,000	\$2.75	0.122	\$0.321	LF-4A: Retrofit Electronic Ballast & 4xF32T8 Lamps, or
F40T12 - 4 Lamps per Fixture - Standard Fixture	172.0	20,000	\$2.75	0.122	\$0.321	LF-4B: Delamping & Reflector + Electronic Ballast and 2xF32T8 Lamps
F48T12VH - 2 Lamps per Fixture - Explosion Proof Fixture	250.0	12,000	\$16.31	0.375	\$2.297	None: Required illumination cannot be achieved with the same number of any other type lamp using less energy, even with an addition of a specular reflector.
I-100W - 1 Lamp per Fixture - Ceiling & Wall Mounted	100.0	750	\$0.51	0.083	\$4.000	LF-5: Replace lamp and base with DTT-26W, 2700K, CRI 80 Compact Fluorescent
I-150W - 1 Lamp per Fixture - Ceiling & Wall Mounted	150.0	750	\$0.51	0.083	\$4.000	LF-6: Replace lamp and base with DTT-26W, 2700K, CRI 80 Compact Fluorescent
MV 175W - Pendant-Mount	198.0	24,000	\$14.10	0.300	\$0.963	LF-7: Retrofit with 50W HPS Lamp & Ballast
MH 400W - Pendant-Mount	460.0	20,000	\$34.05	0.300	\$2.153	LF-8: Retrofit with 250W HPS Lamp & Ballast

[&]quot;Standard Fixtures" are either recessed or surface mounted, including lens.

Lamp replacement labor costs are based on a rate of \$20 per hour plus 50% for burden and overhead. The labor rate is, thus, \$30 per hour.

Table H-15. Energy Use and Operating Costs of Proposed Lighting Fixture Retrofits

Proposed Lighting Fixture (LF) Retrofits	Watts per Fixture	Lamp Life (Hours)	Lamp Cost (\$ Each)	Labor (Hr/Lamp)	Cost/1,000 Lamp-Hrs
Lighting Fixture Delamping with Lamp and Ballast Retrofits	trofits				
LD-1: Delamp and Retrofit from 2-Lamp F40T12 Fixture to a 1-Lamp F32T8 Fixture with Electronic Ballast	31.0	20,000	\$2.83	0.150	\$0.380
LD-2: Delamp and Retrofit from 4-Lamp F40T12 Fixture to a 2-Lamp F32T8 Fixture with Electronic Ballast	61.0	20,000	\$2.83	0.122	\$0.335
Lighting Fixture Lamp and/or Ballast Retrofits					
LF-1: Retrofit LED Lamp Kit in Existing Exit Lights	1.8	220,000	\$31.50	0.083	\$0.155
LF-2: Retrofit Electronic Ballast & 1xF32T8 Lamp	31.0	20,000	\$2.83	0.167	\$0.407
LF-3A: Retrofit Electronic Ballast & 2xF32T8 Lamps, Standard Fixture	61.0	20,000	\$2.83	0.150	\$0.380
LF-3B: Retrofit Electronic Ballast & 2xF32T8 Lamps, Industrial Fixture	61.0	20,000	\$2.83	0.100	\$0.301
LF-4A: Retrofit Electronic Ballast & 4xF32T8 Lamps, or	122.0	20,000	\$2.83	0.122	\$0.335
LF-4B: Delamping & Reflector + Electronic Ballast and 2xF32T8 Lamps	61.0	20,000	\$2.83	0.122	\$0.335
LF-5: Replace lamp and base with DTT-26W, 2700K, CRI 80 Compact Fluorescent	35.0	10,000	\$7.23	0.083	\$0.987
LF-6: Replace lamp and base with DTT-26W, 2700K, CRI 80 Compact Fluorescent	35.0	10,000	\$7.23	0.083	\$0.987
LF-7: Retrofit with 50W HPS Lamp & Ballast	80.0	24,000	\$23.95	0.300	\$1,395
LF-8: Retrofit with 250W HPS Lamp & Ballast	300.0	24,000	\$27.40	0.300	\$1.539

Location:	· · · · · · · · · · · · · · · · · · ·	Ammunition Plant, nilitarization Facility	Region No. 4	Project No.	
Project Title:	ECIP Facility Energ	•		Fiscal Year FY	97
		hting Fixture Retrofits	-		
Analysis Date:	November 1994	Economic Life:	15 Years	Preparer: KELLER	& GANNON
1. Investment C	Costs				
A. Construction	Costs		\$67,303		
B. SIOH			\$4,038		
C. Design Cost			\$4,038		
D. Total Cost (1	· ·		\$75,380		
_	e of Existing Equipm	nent		\$0	_
•	Company Rebate			<u> </u>	
G. Total Investr	nent (1D-1E-1F)				\$75,380
2. Energy Savin	as Li VCostl V				
		Discount Factors: C	October 1994		
Date of thorne	00 0270 0300 101 1	Discount Factors. C	1554		
Energy	Cost	Saving	Annual \$	Discount	Discounted
Source	\$/MBTU	MBTU/Yr(2)	Savings(3)	Factor(4)	Savings(5)
					•
A. Elec.	\$12.82	768.43	\$9,851	12.02	\$118,409
B. Dist	\$13.25	0	\$ 0	14.23	\$ 0
C. LPG					
D. Other					
E. Demand Save			:W \$5,161	12.02	\$62,031
F. Total	(\$/kW-Year)	768.43	\$15,012		\$180,440
3. Non Energy S	avings (+) or Cost	(-):			
A. Annual Recur	-		\$468.03		
(1) Discount Fac		2 4 4 1		11.94	
(2) Discounted 5	Savings/Cost (3A x	3A1)			\$5,588
B. Non Recurring	Savings (+) or Co				
Item	Savings(+)	Discounted Sav-			
	Cost(-)(1)	ings(+)Cost(-)(4)			
a.	3331, 7, 17	Occur. (2)	Factor(3)	mgs(1 /003t(/(+/	
b.				· · · · · · · · · · · · · · · · · · ·	
c.					
d. Total					
C Total Non Ene	rgy Discounted Sav	ings (3A2+3Bd4)		\$5,588	
4. First Year Dol	lar Savings (2F3+3	BA + (3Bd1/Economi	c Life)):	\$15,480	
5. Simple Payba	-		• •	4.87	Years
	counted Savings (2)	F5 + 3C):	,	\$186,029	· _
7. Savings to Inv	estment Ratio (SIR) (6/1G):		2.47	

Location:	Hawthorne Army A Western Area Dem		Region No. 4	Project No.	
Project Title:	ECIP Facility Energ			Fiscal Year FY9	7
	ECO LD-1: Delam	and Retrofit from	2-Lamp F40T12		
	Fixture to a 1-Lamp	F32T8 Fixture wi	th Electronic Ballast		
Analysis Date:	November 1994	Economic Life:	15 Years	Preparer: KELLER	& GANNON
1. Investment C	osts				
A. Construction	Costs		\$270		
B. SIOH			\$16		
C. Design Cost			\$16		
D. Total Cost (1.	A+1B+1C)		\$302		
E. Salvage Value	of Existing Equipm	ent		\$ 0	
F. Public Utility	Company Rebate			\$0	
G. Total Investm	ent (1D-1E-1F)				\$302
2. Energy Saving			-4-1 1004		
Date of NISTIR 8	35-3273 Used for D	iscount Factors: U	CTODER 1994		
Energy	Cost	Saving	Annual \$	Discount	Discounted
Source	\$/MBTU	MBTU/Yr(2)	Savings(3)	Factor(4)	Savings(5)
	,,,,,,				•
A. Elec.	\$12.82	3.00	\$38	12.02	\$462
B. Dist	\$13.25	0	\$ O	14.23	\$O
C. LPG					
D. Other					
E. Demand Save	d \$102.21	0.22	W \$22	12.02	\$270
F. Total	(\$/kW-Year)	3.00	\$61		\$732
3. Non Energy S	avings (+) or Cost	(-):			
A. Annual Recur	ring (+/)		\$6.89		
(1) Discount Fac	_		40.00	11.94	
	Savings/Cost (3A x :	3Δ1)			\$82
(2) Discounted S	adings/cost (OA X t	SA 17			402
B. Non Recurring	Savings (+) or Co	st (-)			
Item	Savings(+)	Year of	Discount	Discounted Sav-	
	Cost(-)(1)	Occur. (2)	Factor(3)	ings(+)Cost(-)(4)	
a.					
b.					
c.					
d. Total					
a. rotai					
C Total Non Ene	rgy Discounted Sav	ings (3A2+3Bd4)		\$82	
4. First Year Dol	lar Savings (2F3 + 3	A + (3Bd1/Economi	c Life)):	\$68	
5. Simple Payba	ck (1G/4):			4.46	Years
6. Total Net Disc	ounted Savings (2F	5+3C):	•	\$815	
	estment Ratio (SIR			2.69	

Location:		Ammunition Plant, nilitarization Facility	Region No. 4	Project No.	
Project Title:	ECIP Facility Energ	•	Fiscal Year FY97		
		p and Retrofit from	110001 1001 11	• ,	
			ith Electronic Ballast		
Analysis Date:	November 1994	Economic Life:		Preparer: KELLER	& GANNON
1. Investment C	osts				
A. Construction	Costs		\$4,704		
B. SIOH			\$282		
C. Design Cost			\$282		
D. Total Cost (1.	A+1B+1C)		\$5,268		
	of Existing Equipr	nent	,2	\$ 0	
_	Company Rebate			\$0	_
G. Total Investm	• •				_ \$5,268
G. 10tal 111403till	ione (ID-IL-II)				45,206
2. Energy Saving	re (+)/Coet(-):				
		Discount Factors: (2-t-h 1004		
Data of MISTIN 6	55-3273 Osed for L	Discount Factors; (October 1994		
Energy	Cost	Coving	Annual \$	Discount	Discounted
Source	\$/MBTU	Saving MBTU/Yr(2)		Discount	Discounted
Source	4/IVID I O	MB10/11(2)	Savings(3)	Factor(4)	Savings(5)
A. Elec.	\$12.82	75.46	\$967	12.02	\$11,627
B. Dist	\$13.25	0	\$O	14.23	\$11,827 \$0
C. LPG	710.20		***	14.25	40
D. Other					
E. Demand Save	d \$102.21	6.33	kW \$647	12.02	\$7,773
F. Total	(\$/kW-Year)	75.46	\$1,614		\$19,400
T. Fotal	(4),000 1001)	70.40	¥1,01 4		\$19, 4 00
3. Non Energy S	avings (+) or Cost	(-):			
A Appual Pagus	-i () ()		4100.04		
A. Annual Recurs (1) Discount Fac			\$196.34	44.04	
		241)		11.94	40.044
(2) Discounted 5	avings/Cost (3A x	3A1)			\$2,344
B. Non Recurring	Savings (+) or Co	ost (-)			
ltem	Savings(+)	Year of	Discount	Discounted Sav-	
110111	Cost(-)(1)	Occur. (2)			
	C08((-)(1)	Occur. (2)	Factor(3)	ings(+)Cost(-)(4)	
8. L					
b. c.					
d. Total					
C Total Non Ener	gy Discounted Sav	rings (3A2+3Bd4)		\$2,344	
4. First Year Doll	ar Savinas (2F3 + 3	3A + (3Bd1/Econom	ic Life)):	\$1,810	
5. Simple Paybac		2.91	Years		
•	ounted Savings (2)	\$21,745	. vais		
	estment Ratio (SIR	4.13			
		7.13			

Location:	Hawthorne Army Ammunition Plant, Western Area Demilitarization Facility			Region No. 4	Project No.		
Project Title:	ECIP Facility Energ ECO LF-1: Retrofi	Fiscal Year FYS	97				
Analysis Date:	November 1994	Economic Life:	15	Years	Preparer: KELLER & GANNON		
1. Investment C	osts						
A. Construction	Costs			\$5,390			
B. SIOH				\$323			
C. Design Cost				\$323			
D. Total Cost (1	A+1B+1C)			\$6,037			
E. Salvage Value	of Existing Equipm	ent			\$0	_	
F. Public Utility	Company Rebate				\$0	_	
G. Total Investm	nent (1D-1E-1F)					\$6,037	
2. Energy Saving	gs (+)/Cost(-):						
Date of NISTIR 8	35-3273 Used for D	iscount Factors:	Octo	ber 1994			
Energy	Cost	Saving		Annual \$	Discount	Discounted	
Source	\$/MBTU	MBTU/Yr(2)		Savings(3)	Factor(4)	Savings(5)	
A. Elec.	\$12.82	43.95		\$563	12.02	\$6,773	
B. Dist	\$13.25	0		\$ 0	14.23	\$0	
C. LPG							
D. Other							
E. Demand Save	d \$102.21	1.47	kW	\$151	12.02	\$1,811	
F. Total	(\$/kW-Year)	43.95		\$714		\$8,584	
3. Non Energy S	avings (+) or Cost	(-):					
A. Annual Recur	ring (+/-)			(\$56.60)			
(1) Discount Fac	_				11.94		
	Savings/Cost (3A x 3	3A1)				(\$676)	
B. Non Recurring	3 Savings (+) or Co	st (-)					
Item	Savings(+)	Year of		Discount	Discounted Sav-		
	Cost(-)(1)	Occur. (2)		Factor(3)	ings(+)Cost(-)(4)		
a.							
b.							
c.							
d. Total							
C Total Non Energy Discounted Savings (3A2+3Bd4)					(\$676)		
4. First Year Dollar Savings (2F3+3A+(3Bd1/Economic Life)):					\$658		
5. Simple Payback (1G/4):					9.18	Years	
8. Total Net Discounted Savings (2F5 + 3C):					\$7,908		
7 Savings to Investment Ratio (SIR) (6/1G):					1 31		

		Ammunition Plant	•	Project No.	
_		gy Improvements:	Fiscal Year FY97		
		it Electronic Ballas	riodar rour i r	0,	
		F40T12 Fixtures			
Analysis Date:	November 1994	Economic Life:	15 Years	Preparer: KELLER	R & GANNON
1. Investment Co	sts				
A. Construction (Costs		\$1,599		
B. SIOH			\$96		
C. Design Cost			\$96		
D. Total Cost (1A	+1B+1C)		\$1,791		
E. Salvage Value	of Existing Equipr	ment		\$0	
F. Public Utility C	ompany Rebate			\$ 0	
G. Total Investme	ent (1D-1E-1F)				 \$1,791
	4.346.343				
2. Energy Savings		-			
Date of NISTIR 8	5-3273 Used for I	Discount Factors:	October 1994		
Energy	Cost	Saving	Annual \$	Discount	Discounted
Source	\$/MBTU	MBTU/Yr(2)	Savings(3)	Factor(4)	Savings(5)
					ouvings(o)
A. Elec.	\$12.82	2.93	\$38	12.02	\$451
B. Dist	\$13.25	0	\$ 0	14.23	\$ O
C. LPG		-			
D. Other		· · · · · · · · · · · · · · · · · · ·			
E. Demand Saved	\$102.21	0.49	kW\$50	12.02	\$607
F. Total	(\$/kW-Year)	2.93	\$88		\$1,058
3. Non Energy Sa	vings (+) or Cost	(-):			
A. Annual Recurri	-		(\$1.12)		
(1) Discount Facto				11.94	
(2) Discounted Sa	vings/Cost (3A x	3A1)			(\$13)
B. Non Recurring	Savings (+) or Co	est (-)			
Item	Savings(+)	Year of	Discount	Discounted Sav-	
	Cost(-)(1)	Occur. (2)	Factor(3)	ings(+)Cost(-)(4)	
a.		00001. (2)	1 40(01(3)	ings(+ /Cos((-)(4)	
b.					
c.					
d. Total					
C Total Non Energ	y Discounted Say	inan 1282 2844)		(440)	
O TOTAL NOTE ETIETS	y Discounted Sav	mys (3AZ+3B04)		(\$13)	
4. First Year Dollar	_	\$87			
5. Simple Payback	(1G/4):	20.60	Years		
6. Total Net Disco	-	\$1,045			
7. Savings to Investment Ratio (SIR) (6/1G):				0.58	

Location:		Ammunition Plant,	Project No.				
Project Title:	ECIP Facility Energy	gy Improvements:	Fiscal Year FY97				
	ECO LF-3A: Retrofit Electronic Ballast & 2xF32T8 Lamps in Existing Standard 2-Lamp F40T12 Fixtures						
Analysis Date:	November 1994	Economic Life:	15 Years	Preparer: KELLER	& GANNON		
1. Investment C	osts						
A. Construction	Costs		\$13,521				
B. SIOH			\$811				
C. Design Cost			\$811				
D. Total Cost (1	A+1B+1C)		\$15,144				
E. Salvage Value	of Existing Equipr	nent		\$ 0	_		
F. Public Utility	Company Rebate			\$ 0	_		
G. Total Investm	nent (1D-1E-1F)				\$15,144		
2 Energy Soving	ns (+\/Cost/-\:						
2. Energy Saving		Discount Factors: (October 1994				
Date of Mistin 6	35-3273 Useu IOI I	Jiscouiit Factors. V	JCtober 1334				
Energy	Cost	Saving	Annual \$	Discount	Discounted		
Source	\$/MBTU	MBTU/Yr(2)	Savings(3)	Factor(4)	Savings(5)		
Source	V/W.D.1.O	141510/11(2)	Odvings(O)	1 dotor(+)	Odvings(O)		
A. Elec.	\$12.82	63.45	\$813	12.02	\$9,778		
B. Dist	\$13.25	0	\$0	14.23	\$ 0		
C. LPG							
D. Other							
E. Demand Save	d \$102.21	4.68	kW\$478	12.02	\$5,743		
F. Total	(\$/kW-Year)	63.45	\$1,291		\$15,521		
3. Non Energy S	avings (+) or Cost	: (-):					
A. Annual Recur	ring (+/-)		(\$32.48)				
(1) Discount Fac	tor (Table A)			11.94			
(2) Discounted S	lavings/Cost (3A x	3A1)			(\$388)		
		. 43					
B. Non Recurring	3 Savings (+) or Co	ost (-)					
lå ama	Savings(+)	Year of	Discount	Discounted Sav-			
Item	-						
_	Cost(-)(1)	Occur. (2)	Factor(3)	ings(+)Cost(-)(4)			
8. L		· · · · · · · · · · · · · · · · · · ·					
b.							
c.							
d. Total							
C Total Non Ene	rgy Discounted Sav	(\$388)					
4. First Year Doll	lar Savings (2F3 + 3	\$1,259					
5. Simple Payba	=	12.03	Years				
· · · · · ·	counted Savings (2	\$15,133					
	estment Ratio (SIF	1.00					
	•	•					

Location:	Hawthorne Army Ammunition Plant, Region No. 4 Western Area Demilitarization Facility			Project No.	
Project Title:	ECIP Facility Energ	gy Improvements:	Fiscal Year FY	97	
	Lamps in Existing				
Analysis Date:	November 1994	Economic Life:		Preparer: KELLER	& GANNON
1. Investment Co	osts				
A. Construction	Costs		\$22,297		
B. SIOH			\$1,338		
C. Design Cost			<u>\$1,338</u>		
D. Total Cost (1)			\$24,973		
	of Existing Equipn	nent		\$0	
F. Public Utility				<u> </u>	_
G. Total Investm	ent (1D-1E-1F)				\$24,973
2. Energy Saving					
Date of NISTIR 8	35-3273 Used for [Discount Factors:	October 1994		
Energy	Cost	Saving	Annual \$	Discount	Discounted
Source	\$/MBTU	MBTU/Yr(2)	Savings(3)	Factor(4)	Savings(5)
A. Elec.	\$12.82	74.71	\$958	12.02	\$11,512
B. Dist	\$13.25	0	\$ 0	14.23	\$ 0
C. LPG	*		•		
D. Other			•		
E. Demand Save		8.10	kW <u>\$828</u>	12.02	\$9,951
F. Total	(\$/kW-Year)	74.71	\$1,786		\$21,463
3. Non Energy S	avings (+) or Cost	(-):			
A. Annual Recur	rina (+/-)		(\$28.94)		
(1) Discount Fact	•			11.94	
(2) Discounted S	avings/Cost (3A x	3A1)			(\$346)
B. Non Recurring	Savings (+) or Co	ost (-)			
Item	Savings(+)	Year of	Discount	Discounted Sav-	
	Cost(-)(1)	Occur. (2)	Factor(3)	ings(+)Cost(-)(4))
a.					•
b.					
c.					
d. Total					
C Total Non Ener	gy Discounted Sav	(\$346)			
4. First Year Doll	ar Savings (2F3+3	A + (3Bd1/Fconon	nic Life))•	\$1,757	
5. Simple Paybac	_	, , , , , , , , , , , , , , , , , ,		14.22	Years
	ounted Savings (2F	\$21,118	. 0010		
	estment Ratio (SIR)	0.85			
		0.00			

Location:	Hawthorne Army Ammunition Plant, Western Area Demilitarization Facility			Region No. 4	Project No.	
Project Title:	ECIP Facility Energy Improvements: ECO LF-4A: Retrofit Electronic Ballast & 4 x F32T8			Fiscal Year FYS	97	
	Lamps in Existing	4-Lamp F40T12 Fi	ixtur	es, or		
Analysis Date:	November 1994	Economic Life:	15	Years	Preparer: KELLER	& GANNON
1. Investment Co	osts					
A. Construction	Costs			\$16,241		
B. SIOH				\$974		
C. Design Cost				\$974		
D. Total Cost (1)	A + 1B + 1C)			\$18,190		
E. Salvage Value	of Existing Equipm	ent			<u> </u>	-
F. Public Utility (Company Rebate				\$0	-
G. Total Investm	ent (1D-1E-1F)					\$18,190
2. Energy Saving						
Date of NISTIR 8	5-3273 Used for D	iscount Factors: (Octo	ber 1994		
Energy	Cost	Saving		Annual \$	Discount	Discounted
Source	\$/MBTU	MBTU/Yr(2)		Savings(3)	Factor(4)	Savings(5)
				-		_
A. Elec.	\$12.82	83.44		\$1,070	12.02	\$12,858
B. Dist	\$13.25			\$0	14.23	\$ O
C. LPG						
D. Other	. ———					
E. Demand Save		5.90	kW	\$603	12.02	\$7,248
F. Total	(\$/kW-Year)	83.44		\$1,673		\$20,106
3. Non Energy S	evings (+) or Cost	(-):				
A. Annual Recur	ring (+/-)			(\$36.42)		
(1) Discount Fact	tor (Table A)			_	11.94	
(2) Discounted S	avings/Cost (3A x 3	BA1)				(\$435)
B. Non Recurring	Savings (+) or Co	st (-)				
Item	Savings(+)	Year of		Discount	Discounted Sav-	
	Cost(-)(1)	Occur. (2)		Factor(3)	ings(+)Cost(-)(4)	
a.						
b.						
c.						
d. Total			•			
C Total Non Energy Discounted Savings (3A2+3Bd4)					(\$435)	
4. First Year Dollar Savings (2F3+3A+(3Bd1/Economic Life)):					\$1,636	
5. Simple Payback (1G/4):					11.12	Years
6. Total Net Discounted Savings (2F5+3C):					\$19,671	
7. Savings to Investment Ratio (SIR) (6/1G):					1.08	

Location:		Ammunition Plant,	-	Project No.	
Project Title:	ECIP Facility Energ		Fiscal Year FY	·07	
Trojout Trac.	-	mp to 2xF32T8 La	riscal fear Pf	97	
			mp F40T12 Fixtures		
Analysis Date:	November 1994	Economic Life:		Danasan VELLER	
Analysis Date.	November 1994	Economic Life:	15 Tears	Preparer: KELLER	& GANNON
1. Investment Co	osts				
A. Construction	Costs		\$8,862		
B. SIOH			\$532		
C. Design Cost			\$532		
D. Total Cost (1)	A+1B+1C)		\$9,925		
E. Salvage Value	of Existing Equipm	nent	70,020	\$ O	
F. Public Utility (\$0	-
G. Total Investm					 60 025
					\$9,925
2. Energy Saving	is (+)/Cost(-):				
		Discount Factors: (October 1994		
	0 0270 0300 107 1	Discount l'actors.	October 1994		
Energy	Cost	Saving	Annual \$	Discount	D:
Source	\$/MBTU	MBTU/Yr(2)	Savings(3)		Discounted
	¥7,4151 G	141010/11(2)	Saviiiĝs(S)	Factor(4)	Savings(5)
A. Elec.	\$12.82	185.24	\$2,375	12.02	620 EAA
B. Dist	\$13.25	0	\$O	14.23	\$28,544 \$0
C. LPG			70	14.23	40
D. Other					
E. Demand Saved	\$102.21	13.10	kW \$1,339	12.02	\$16,091
F. Total	(\$/kW-Year)	185.24	\$3,713		\$44,635
	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		40,710		944 ,035
3. Non Energy Sa	vings (+) or Cost	(-):			
A. Annual Recurr	-		\$371.38		
(1) Discount Fact	•			11.94	
(2) Discounted Sa	avings/Cost (3A x	3A1)			\$4,434
B. Non Recurring	Savings (+) or Co	ost (-)			
1.	.				
Item	Savings(+)	Year of	Discount	Discounted Sav-	
	Cost(-)(1)	Occur. (2)	Factor(3)	ings(+)Cost(-)(4)	
a.					
b.					
c.	*			 	
d. Total					
C Total Non Energ	gy Discounted Sav	ings (3A2 + 3PdA)		64.404	
	, 2.000antou Odv	mga (OMZ TODU4)		\$4,434	
4. First Year Dolla	ır Savinas (2F3+3	A + (3Bd1/Econom	ic Life)):	\$4,085	
5. Simple Payback		2.43	Years		
	ounted Savings (2F	\$49,069	ı Q alə		
	estment Ratio (SIR)	4.94			
		4.34			

Location:	•	Ammunition Plant, nilitarization Facility	Region No. 4	Project No.	
Project Title:	ECIP Facility Energ	•		Fiscal Year FY	97
	-	• •	ent lamp and base with		•
	· ·		luorescent & Ballast		
Analysis Date:	November 1994	Economic Life:		Preparer: KELLER	S. C.ANNON
randing batter	11010111001 1004	Leonomic Life.	10 10016	Fiehalel: KELLEN	& GANNON
1. Investment Co					
A. Construction	Costs		\$276		
B. SIOH			\$17		
C. Design Cost			<u> </u>		
D. Total Cost (1/	A+1B+1C)		\$309		
E. Salvage Value	of Existing Equipm	nent		\$0	
F. Public Utility (Company Rebate			\$ O	_
G. Total Investm	ent (1D-1E-1F)				\$309
2. Energy Saving	s (+)/Cost(-):				
Date of NISTIR 8	5-3273 Used for D	iscount Factors: O	ctober 1994		
_					
Energy	Cost	Saving	Annual \$	Discount	Discounted
Source	\$/MBTU	MBTU/Yr(2)	Savings(3)	Factor(4)	Savings(5)
A. Elec.	\$12.82	4.66	\$60	12.02	\$718
B. Dist	\$13.25	0	\$O	14.23	\$0
C. LPG			70	14.20	40
D. Other					
E. Demand Saved	\$102.21	0.39 k	W \$40	12.02	\$479
F. Total	(\$/kW-Year)	4.66	\$100		\$1,197
	(1),,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	4.00	¥100		VI,137
3. Non Energy Sa	vings (+) or Cost	(-):			
A. Annual Recurr	ing (+/-)		\$63.30		
(1) Discount Fact	•		- 400.00	11.94	
	evings/Cost (3A x 3	RA1)		11.54	67E0
(2) 2,00001,100 01	go, ooot (o/\ x \)A17			\$75 8
B. Non Recurring	Savings (+) or Co	st (-)			
Item	Savings(+)	Year of	Discount	D:	
10011	=			Discounted Sav-	
	Cost(-)(1)	Occur. (2)	Factor(3)	ings(+)Cost(-)(4)	
a. L					
b. c.					
d. Total					
C Total Non Energ	gy Discounted Savi	ngs (3A2+3Bd4)		\$756	
4. First Year Dolla	r Savings (2F3 + 3	A + (3Bd1/Economic	: Life)):	\$163	
5. Simple Paybacl				1.90	Years
•	ounted Savings (2F	5+3C):	•	\$1,953	
	estment Ratio (SIR)			6.33	
_	-				

Location:	Hawthorne Army A		_	Project No.	
Project Title:	ECIP Facility Energ		-	Fiscal Year FY	97
,			scent lamp and base with		07
			t Fluorescent & Ballast		
Analysis Date:	November 1994	Economic Life		D VELLED	R CANDION
Analysis Date.	November 1334	Economic File	. 15 18818	Preparer: KELLER	& GANNON
1. Investment Co	osts	70.74			
A. Construction	Costs		\$138		
B. SIOH			\$8		
C. Design Cost			\$8		
D. Total Cost (1)	A+1B+1C)		\$154		
E. Salvage Value	of Existing Equipm	nent		\$ 0	
F. Public Utility (Company Rebate			\$0	
G. Total Investm	ent (1D-1E-1F)				- \$154
2. Energy Saving	s (+)/Cost(-):				
	5-3273 Used for D	iscount Factors:	October 1994		
Energy	Cost	Saving	Annual \$	Discount	Discounted
Source	\$/MBTU	MBTU/Yr(2)	Savings(3)	Factor(4)	Savings(5)
			,	,	outgo(o)
A. Elec.	\$12.82	0.73	\$9	12.02	\$113
B. Dist	\$13.25	0	\$0	14.23	\$0
C. LPG			•		
D. Other			•		
E. Demand Saved	\$102.21	0.35	- kW \$35	12.02	\$424
F. Total	(\$/kW-Year)	0.73	\$45		\$537
3. Non Energy Sa	avings (+) or Cost	(-):			
A Annual Basser	in- (,		AE 04		
A. Annual Recurr (1) Discount Fact	=		\$5.64		
	evings/Cost (3A x 3	241		11.94	4.4-
(2) Discounted 5	avings/Cost (3A X 3	5A 1)			\$67
B. Non Recurring	Savings (+) or Co	st (-)			
Item	Savings(+)	Year of	Discount	D:	
Itom	Cost(-)(1)	Occur. (2)		Discounted Sav-	
8.	COSt(-)(1)	Occur. (2)	Factor(3)	ings(+)Cost(-)(4)	
b.	····	-	•		
c.			•		
d. Total					
u. rotai					
C Total Non Energ	gy Discounted Savi	ngs (3A2+3Bd4)	\$67	
4. First Year Dolla	ar Savings (2F3+3	A + (3Bd1/Econor	nic Life)):	\$50	
5. Simple Paybac				3.07	Years
6. Total Net Disco	ounted Savings (2F	5+3C):	•	\$604	
7. Savings to Inve	estment Ratio (SIR)	(6/1G):		3.91	

Location:	-	Ammunition Plant,	Region No. 4	Project No.	
Project Titles	ECIP Facility Energ	•		Fiscal Year FY	a7
Project Title:	•	gy improvements: it Existing 175W M	V Exterior Light	riscal fear FT	97
		-	=		
		/ HPS Lamps & Ball			
Analysis Date:	November 1994	Economic Life:	15 Years	Preparer: KELLER	& GANNON
1. Investment C	osts				
A. Construction	Costs		\$22,314		
B. SIOH			\$1,339		
C. Design Cost			\$1,339		
D. Total Cost (1	A+1B+1C)		\$24,991		
E. Salvage Value	e of Existing Equipr	nent	•	\$ O	
	Company Rebate			\$0	-
G. Total Investm					- \$24,991
					,,
2. Energy Savin	as (+)/Cost(-):				
	*	Discount Factors: O	october 1994		
Date of Moth	00-02/0 0884 101 1	Discount Factors. C	CODE 1004		
Energy	Cost	Saving	Annual \$	Discount	Discounted
Source	\$/MBTU	MBTU/Yr(2)	Savings(3)	Factor(4)	Savings(5)
Cource	47141510	141510/11(2)	OBAIII Ba(O)	r actor(+)	Savings(S)
A. Elec.	\$12.82	242.76	\$3,112	12.02	\$37,407
B. Dist	\$13.25	0	\$O	14.23	\$0
C. LPG					
D. Other					
E. Demand Save	sd \$102.21	16.28	cW \$1,664	12.02	\$20,005
F. Total	(\$/kW-Year)	242.76	\$4,776		\$57,413
1. Total	(4/64-1001)	242.70	44,770		407,413
3. Non Energy S	savings (+) or Cost	(-):			
			44000 000		
A. Annual Recur	- ' '		(\$260.96)	44.54	
(1) Discount Fac	•	0.4.4.1		11.94	
(2) Discounted S	Savings/Cost (3A x	3A1)			(\$3,116)
B. Non Recurring	g Savings (+) or Co	ost (-)			
Item	Savings(+)	Year of	Discount	Discounted Sav-	
	Cost(-)(1)	Occur. (2)	Factor(3)	ings(+)Cost(-)(4)	
a.					
b.					
C.		======================================			
d. Total					
C Total Non Ene	rgy Discounted Sav	rings (3A2+3Bd4)		(\$3,116)	
4 First Voor Dal	ler Sevinge /2E2 + 3	BA + (3Bd1/Economi	o Life)):	<i>€A</i> E1E	
5. Simple Payba	-	/A + (354 1/ECONOMI	C 110//.	\$4,515 5.52	Vaces
		E5 + 2C/-		5.53	Years
	counted Savings (2)			\$54,297 2.17	
. Savings to inv	restment Ratio (SIR	<i>)</i> (0/10):		2.17	

Location:		Ammunition Plant	•	Project No.	
_		gy Improvements:	•	Fiscal Year FY	70.7
	=		Metal Halide Explosion		97
		OW HPS Lamps &		111001	
	November 1994			--	
Analysis Date.	November 1994	Economic Life:	: 15 Years	Preparer: KELLEF	R & GANNON
1. Investment Co	nete				
A. Construction			\$0.004		
B. SIOH	Costs		\$9,804		
C. Design Cost			\$588		
-	4D . 4O		\$588		
D. Total Cost (14	· · · · -•		\$10,980		
	of Existing Equip	ment		<u> </u>	_
F. Public Utility C				<u>\$0</u>	_
G. Total Investme	ent (1D-1E-1F)				\$10,980
2. Energy Saving					
Date of NISTIR 8	5-3273 Used for 1	Discount Factors:	October 1994		
F	•				
Energy	Cost	Saving	Annual \$	Discount	Discounted
Source	\$/MBTU	MBTU/Yr(2)	Savings(3)	Factor(4)	Savings(5)
A. Elec.	\$12.82	132.49	61 600	40.00	400 440
B. Dist	\$13.25	0	\$1,698	12.02	\$20,415
C. LPG	<u> </u>		\$ 0	14.23	\$ 0
D. Other			•		
E. Demand Saved	\$102.21	7.00			
		7.68	kW <u>\$785</u>	12.02	\$9,435
F. Total	(\$/kW-Year)	132.49	\$2,483		\$29,850
3. Non Energy Sa	vings (+) or Cost	(-):			
A. Annual Recurri	_		\$174.52		
(1) Discount Facto	•			11.94	
(2) Discounted Sa	vings/Cost (3A x	3A1)			\$2,084
B. Non Recurring	Savings (+) or Co	ost (-)			
Item	Savin mat 1.		.		
item	Savings(+)	Year of	Discount	Discounted Sav-	
_	Cost(-)(1)	Occur. (2)	Factor(3)	ings(+)Cost(-)(4)	
8.					
b.					
C.					
d. Total					
C Total Non Energ	y Discounted Sav	rings (3A2+3Bd4)		\$2,084	
4 First Vaca Delle	- Cavinas (250 - 2	A . 100 44 15			
4. First Year Dollar		A + (3Bd1/Econom	nic Life)):	\$2,658	
5. Simple Payback			,	4.13	Years
6. Total Net Disco				\$31,934	
7. Savings to Inve	stment Ratio (SIR) (8/1G):		2.91	

Project No. Region No. 4 Hawthorne Army Ammunition Plant, Location: Western Area Demilitarization Facility **ECIP Facility Energy Improvements:** Fiscal Year FY97 Project Title: ECO LC-1: Lighting Control Retrofit: Install Ceiling Mounted Passive Infrared (PIR) Motion Sensors Economic Life: 15 Years November 1994 Preparer: KELLER & GANNON Analysis Date: 1. Investment Costs A. Construction Costs \$8,541 B. SIOH \$512 \$512 C. Design Cost \$9,566 D. Total Cost (1A + 1B + 1C) \$0 E. Salvage Value of Existing Equipment \$0 F. Public Utility Company Rebate G. Total Investment (1D-1E-1F) \$9,566 2. Energy Savings (+)/Cost(-): Date of NISTIR 85-3273 Used for Discount Factors: October 1994 Cost Saving Annual \$ Discount Discounted Energy \$/MBTU Savings(3) Factor(4) Savings(5) Source MBTU/Yr(2) A. Elec. \$12.82 33.16 \$425 12.02 \$5,109 B. Dist \$13.25 \$0 14.23 \$0 0 C. LPG D. Other 0.00 kW 12.02 E. Demand Saved \$102.21 \$0 \$0 F. Total (\$/kW-Year) 33.16 \$425 \$5,109 3. Non Energy Savings (+) or Cost (-): A. Annual Recurring (+/-) \$0.00 11.94 (1) Discount Factor (Table A) (2) Discounted Savings/Cost (3A x 3A1) \$0 B. Non Recurring Savings (+) or Cost (-) Savings(+) Year of **Discount** Discounted Savitem Cost(-)(1) Occur. (2) Factor(3) ings(+)Cost(-)(4)a. b. c. d. Total C Total Non Energy Discounted Savings (3A2+3Bd4) \$0 4. First Year Dollar Savings (2F3+3A+(3Bd1/Economic Life)): \$425 5. Simple Payback (1G/4): 22.51 Years 6. Total Net Discounted Savings (2F5+3C): \$5.109 7. Savings to Investment Ratio (SIR) (6/1G): 0.53

Location:		Ammunition Plant, nilitarization Facility	Region No. 4	Project No.	
Project Title:		gy Improvements:		Fiscal Year FY	27
rrojoet ride.		ng Control Retrofit:	Install Ceiling	riscai reai - ri	• /
		ic Motion Sensors	g		
Analysis Date:	November 1994	Economic Life:	15 Years	Preparer: KELLER	& GANNON
•					
1. Investment C	osts				
A. Construction	Costs		\$6,050		
B. SIOH			\$363		
C. Design Cost			\$363		
D. Total Cost (1	A+1B+1C)		\$6,776		
E. Salvage Value	e of Existing Equipr	ment		\$0	_
F. Public Utility	Company Rebate			\$0	-
G. Total Investm	nent (1D-1E-1F)				- \$6,776
2. Energy Saving	gs (+)/Cost(-):				
		Discount Factors: O	ctober 1994		
Energy	Cost	Saving	Annual \$	Discount	Discounted
Source	\$/MBTU	MBTU/Yr(2)	Savings(3)	Factor(4)	Savings(5)
			• • •		
A. Elec.	\$12.82	10.13	\$130	12.02	\$1,561
B. Dist	\$13.25	0	\$ 0	14.23	\$ 0
C. LPG					
D. Other					
E. Demand Save	d \$102.21	0.00	cW\$0	0.00	\$ O
F. Total	(\$/kW-Year)	10.13	\$130		\$1,561
3. Non Energy S	avings (+) or Cost	(-):			
A. Annual Recur	_		\$0.00		
(1) Discount Fac	•			11.94	
(2) Discounted S	Savings/Cost (3A x	3A1)			\$ 0
B. Non Recurring	g Savings (+) or Co	ost (-)			
Item	Savings(+)	Year of	Discount	Discounted Sav-	
Item	Cost(-)(1)	Occur. (2)	Factor(3)		
_	COS((-)(1)	Occur. (2)	Factor(3)	ings(+)Cost(-)(4)	
a. b.					
о. С.					
d. Total					
C Total Non Ene	rgy Discounted Sav	vings (3A2+3Bd4)		\$0	
4. First Year Doll	lar Savings (2F3 +3	3A + (3Bd1/Economi	c Life)):	\$130	
5. Simple Paybac	=	. ,. =,===		52.16	Years
	counted Savings (2)	F5+3C):		\$1,561	. 54.0
	estment Ratio (SIR			0.23	
-	,				

Project Title: ECIP Facility Energy Improvements: ECIP Facility Energy	Location:	Hawthorne Army	Ammunition Plant, nilitarization Facility	Region No. 4	Project No.	
ECO LC-3: Lighting Control Ratrofit: Replace Wall-Switches	Project Titles		•		Fieral Vaer FV9	17
Passive Infrared (FIR) Motion Sensor Switches Analysis Date: November 1994 Economic Life: 15 Years Preparer: KELLER & GANNON 1. Investment Costs \$2,026 A. Construction Costs \$122 C. Design Cost \$122 D. Total Cost (1/A + 1B + 1C) \$2,269 E. Salvage Value of Existing Equipment \$0 F. Public Utility Company Rebate \$0 G. Total Investment (1D-1E-1F) \$2,269 2. Energy Sevings (+)/Cost(-): Date of NISTIR 85-3273 Used for Discount Factors: October 1994 Energy Cost Saving Annual \$ Discount Discounted Source \$1/MBTU MBTU/Vr(2) Savings(3) Factor(4) Savings(5) A. Elec. \$12.82 16.68 \$214 12.02 \$2,571 B. Dist \$913.25 0 \$0 14.23 \$0 C. LPG	Project Title.		•	Replace Well-Switch		, ,
1.		_			100 111111	
A. Construction Costs B. SIOH C. Design Cost B. SIOH C. Design Cost B. Salvage Value of Existing Equipment F. Public Utility Company Rebate G. Total Investment (1D-1E-1F) 2. Energy Savings (+)/Cost(-): Date of NISTIR 85-3273 Used for Discount Fectors: October 1994 Energy Cost Saving Annual \$ Discount Discount Discount Pactors: October 1994 Energy Cost Saving Annual \$ Discount Discount Discount Pactors: October 1994 Energy Cost Saving Annual \$ Discount Discount Discounted Savings(3) Factor(4) Savings(5) A. Elec. \$12.82 16.88 \$214 12.02 \$2.571 A. Elec. S12.82 0 \$0 14.23 \$0 C. LPG D. Other E. Demend Saved \$102.21 0.00 kW \$0 14.23 \$0 F. Total A. Annual Recurring (+/-) (9/kW-Year) 16.88 \$214 \$2.571 3. Non Energy Savings (+) or Cost (-): A. Annual Recurring Savings (+) or Cost (-): B. Non Recurring Savings (+) or Cost (-): Cost(-)(1) Occur. (2) Factor(3) B. Non Recurring Savings (+) or Cost (-) Cottal Non Energy Discounted Savings (3A2+3Bd4) 4. First Year Dollar Savings (2F3+3A+(3Bd1/Economic Life)): \$2. Simple Payback (1G/4): 10. Simple Payback (1G/4): 10. Total C. Total Not Discounted Savings (2F5+3C): \$2.571	A 1 ' D-1				Deserve VELLER	e CANNON
A. Construction Costs	Analysis Date:	November 1994	Economic Lite:	15 Years	Preparer: KELLEK	& GANNUN
B. SIOH C. Design Cost D. Total Cost (1A+1B+1C) E. Salvage Value of Existing Equipment F. Public Utility Company Rebate G. Total Investment (1D-1E-1F) 2. Energy Savings (+)/Cost(-): Date of NISTIR 85-3273 Used for Discount Factors: October 1994 Energy Cost Seving Annual \$ Discount Discount Discounted Savings(5) A. Elec. \$12.82 16.68 \$214 12.02 \$2,571 B. Dist \$13.25 0 \$0 14.23 \$0 C. LPG D. Other E. Damend Saved \$102.21 0.00 kW \$0 14.23 \$0 F. Total (\$/kW-Year) 16.68 \$214 \$2,571 3. Non Energy Sevings (+) or Cost (-): A. Annual Recurring (+/-) (1) Discount Factor (Table A) (2) Discounted Savings/Cost (3A x 3A1) B. Non Recurring Savings (+) or Cost (-) Item Savings(+) Year of Discount Discounted Savings (3A2+3B44) C. Total Non Energy Discounted Savings (3A2+3B44) 4. First Year Dollar Sevings (2F3+3A+(3Bd1/Economic Life)): \$2,571 \$2. Simple Payback (1G/4): 10.61 Years \$2.571	1. Investment C	osts				
C. Design Cost D. Total Cost (1A + 1B + 1C) E. Salvage Value of Existing Equipment F. Public Utility Company Rebate G. Total Investment (1D-1E-1F) 2. Energy Savings (+)/Cost(-): Date of NISTIR 85-3273 Used for Discount Factors: October 1994 Energy Cost Saving Annual \$ Discount Discount Discount Savings (3) Savings(3) Factor(4) Savings(5) A. Elec. \$12.82 16.68 \$214 12.02 \$2.571 B. Dist \$13.25 0 \$0 14.23 \$0 C. LPG D. Other E. Demand Saved \$102.21 0.00 kW \$0 14.23 \$0 F. Total (\$\frac{1}{2}\$kW-Year) 16.88 \$214 \$2.571 3. Non Energy Sevings (+) or Cost (-): A. Annual Recurring (+/-) (1) Discount Factor (Table A) (2) Discounted Savings/Cost (3A x 3A1) B. Non Recurring Savings (+) or Cost (-) Item Savings(-) Year of Discount Discounted Savings (3A2 + 3B44) C. Total C. Total Non Energy Discounted Savings (3A2 + 3B44) 4. First Year Dollar Savings (2F3 + 3A + (3B41/Economic Life)): \$2.571 4. First Year Dollar Savings (2F5 + 3C): \$2.571	A. Construction	Costs		\$2,026		
D. Total Cost (1A+1B+1C) \$2,269 E. Salvage Value of Existing Equipment F. Public Utility Company Rebate G. Total Investment (1D-1E-1F) 2. Energy Savings (+)/Cost(-): Date of NISTIR 85-3273 Used for Discount Factors: October 1994 Energy Cost Saving Annual Discount Factors: October 1994 Energy Cost Saving Annual Factor(4) Savings(5) A. Elec. \$12.82 16.68 \$214 12.02 \$2.571 B. Dist \$13.25 0 \$0 14.23 \$0 C. LPG D. Other E. Demand Saved \$102.21 0.00 kW \$0 14.23 \$0 F. Total (\$/kW-Year) 16.68 \$214 \$2.571 3. Non Energy Savings (+) or Cost (-): A. Annual Recurring (+/-) (1) Discount Factor (Table A) (2) Discounted Savings/Cost (3A x 3A1) B. Non Recurring Savings (+) or Cost (-) Item Savings(+) Year of Discount Discounted Savings (2F3 + 3A + (3Bd1/Economic Life)): \$0 C. d. Total C Total Non Energy Discounted Savings (3A2 + 3Bd4) 4. First Year Dollar Savings (2F3 + 3A + (3Bd1/Economic Life)): \$2,571 5. Simple Payback (1G/4): 10.61 Years 5. Simple Payback (1G/4): 10.61 Years 5. Simple Payback (1G/4): 10.61 Years 5. Simple Payback (1G/4): 10.61 Years 6. Total Not Discounted Savings (2F5 + 3C): \$2,571	B. SIOH			\$122		
Salvage Value of Existing Equipment	C. Design Cost			\$122		
E. Salvage Value of Existing Equipment F. Public Utility Company Rebate G. Total Investment (1D-1E-1F) 2. Energy Sevings (+)/Cost(-): Date of NISTIR 85-3273 Used for Discount Factors: October 1994 Energy Cost Saving Annual \$ Discount Discount Discount Savings (3) Factor(4) Savings(5) A. Elec. \$12.82 16.68 \$214 12.02 \$2.571 B. Dist \$13.25 0 \$0 14.23 \$0 C. LPG D. Other E. Demand Saved \$102.21 0.00 kW \$0 14.23 \$0 F. Total \$(\$/kW-Year)\$ 16.68 \$214 \$2.571 3. Non Energy Savings (+) or Cost (-): A. Annual Recurring (+/-) (1) Discounted Savings/Cost (3A x 3A1) \$0 B. Non Recurring Savings (+) or Cost (-) Item Savings(-) Year of Discount Cost (-): Item Savings(-) Year of Discount Cost (-): B. Non Recurring Savings (+) or Cost (-) Cost(-)(1) Occur. (2) Factor(3) Discounted Savings(-) (-) (-) (-) (-) (-) (-) (-) (-) (-)	D. Total Cost (1	A + 1B + 1C)		\$2,269		
### Space Sp	•		nent		\$ 0	
### Savings (+) / Cost (-): 2. Energy Savings (+) / Cost(-): Date of NISTIR 85-3273 Used for Discount Factors: October 1994	-				\$0	•
2. Energy Savings (+)/Cost(-): Date of NISTIR 85-3273 Used for Discount Factors: October 1994 Energy Cost Saving Annual \$ Discount Discount Source \$/MBTU MBTU/Yr(2) Savings(3) Factor(4) Savings(5) A. Elec. \$12.82 18.68 \$214 12.02 \$2,571 B. Dist \$13.25 0 \$0 14.23 \$0 C. LPG 0.00 kW \$0 14.23 \$0 F. Total \$102.21 0.00 kW \$0 14.23 \$0 F. Total \$(\$/kW-Year) 16.68 \$214 \$2,571 \$0 3. Non Energy Savings (+) or Cost (-): ** ** \$0 ** \$0 ** \$0 ** \$0 ** \$0 ** \$0 ** \$0 ** \$0 ** \$0 ** \$0 ** \$0 ** \$0 ** \$0 ** \$0 ** \$0 ** \$0 ** \$0 ** \$0 ** ** \$0 ** \$0						- \$2,269
Date of NISTIR 85-3273 Used for Discount Factors: October 1994	G. Yota arrosa.	ione (i b i b i i i i				· - /
Date of NISTIR 85-3273 Used for Discount Factors: October 1994	2 Fnerov Savin	as (+)/Cost(-):				
Energy Cost Saving Annual \$ Discount Source \$ \$/MBTU MBTU/Yr(2) Savings(3) Factor(4) Savings(5) A. Elec. \$12.82			Discount Factors: O	ctober 1994		
Source \$/MBTU MBTU/Yr(2) Savings(3) Factor(4) Savings(5) A. Elec. \$12.82	Date of Mornit	00-0270 0300 101 0	7,500ant 1 actors. •	010001 1004		
Source \$/MBTU MBTU/Yr(2) Savings(3) Factor(4) Savings(5) A. Elec. \$12.82	Enorgy	Cost	Sevina	Annual \$	Discount	Discounted
A. Elec. \$12.82			=			
B. Dist \$\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	Source	4/IVID I O	MB10/11(2)	Savirigs(S)	ractor(+)	Ogviiige(O)
C. LPG D. Other E. Demand Saved \$102.21 0.00 kW \$0 14.23 \$0 F. Total (\$/kW-Year) 16.68 \$214 \$2.571 3. Non Energy Savings (+) or Cost (-): A. Annual Recurring (+/-) \$0.00 (1) Discount Factor (Table A) (2) Discounted Savings/Cost (3A x 3A1) \$0 B. Non Recurring Savings (+) or Cost (-) Item Savings(+) Year of Discount Cost(-)(1) Occur. (2) Factor(3) ings(+)Cost(-)(4) a. b. c. d. Total C Total Non Energy Discounted Savings (3A2+3Bd4) \$0 4. First Year Dollar Savings (2F3+3A+(3Bd1/Economic Life)): \$214 5. Simple Payback (1G/4): 10.61 Years \$6. Total Net Discounted Savings (2F5+3C): \$2,571	A. Elec.	\$12.82	16.68	\$214	12.02	\$2,571
D. Other E. Demand Saved \$\frac{\\$102.21}{(\\$/kW-Year)}\$ \ \frac{16.68}{16.68}\$ \ \\$214 \ \ \\$2,571 3. Non Energy Savings (+) or Cost (-): A. Annual Recurring (+/-) (1) Discount Factor (Table A) (2) Discounted Savings/Cost (3A x 3A1) B. Non Recurring Savings (+) or Cost (-) Item Savings(+) Year of Discount Cost(-)(1) Occur. (2) Factor(3) ings(+)Cost(-)(4) a.	B. Dist	\$13.25	0	\$ 0	14.23	\$ 0
E. Demand Saved \$102.21	C. LPG					
F. Total (\$/kW-Year) 16.68 \$214 \$2,571 3. Non Energy Sevings (+) or Cost (-): A. Annual Recurring (+/-) \$0.00 (1) Discount Factor (Table A) 11.94 (2) Discounted Savings/Cost (3A x 3A1) \$0 B. Non Recurring Savings (+) or Cost (-) Item Savings(+) Year of Discount Discounted Savings(-)(1) Occur. (2) Factor(3) ings(+)Cost(-)(4) a.	D. Other					
F. Total (\$/kW-Year) 16.68 \$214 \$2,571 3. Non Energy Sevings (+) or Cost (-): A. Annual Recurring (+/-) \$0.00 (1) Discount Factor (Table A) 11.94 (2) Discounted Savings/Cost (3A x 3A1) \$0 B. Non Recurring Savings (+) or Cost (-) Item Savings(+) Year of Discount Discounted Savings(-)(1) Occur. (2) Factor(3) ings(+)Cost(-)(4) a.	E. Demand Save	ed \$102.21	0.00 k	:W \$0	14.23	\$ O
3. Non Energy Savings (+) or Cost (-): A. Annual Recurring (+/-) (1) Discount Factor (Table A) (2) Discounted Savings/Cost (3A x 3A1) B. Non Recurring Savings (+) or Cost (-) Item Savings(+) Year of Discount Discounted Savings(-)(-)(1) Occur. (2) Factor(3) ings(+)Cost(-)(4) a.	F. Total	(\$/kW-Year)	16.68	\$214		\$2,571
A. Annual Recurring (+/-) \$0.00 (1) Discount Factor (Table A) 11.94 (2) Discounted Savings/Cost (3A x 3A1) \$0 B. Non Recurring Savings (+) or Cost (-) Item Savings(+) Year of Discount Cost(-)(1) Occur. (2) Factor(3) ings(+)Cost(-)(4) a. b. c. d. Total C Total Non Energy Discounted Savings (3A2+3Bd4) \$0 4. First Year Dollar Savings (2F3+3A+(3Bd1/Economic Life)): \$214 5. Simple Payback (1G/4): 10.61 Years \$2,571						
(1) Discount Factor (Table A) (2) Discounted Savings/Cost (3A x 3A1) B. Non Recurring Savings (+) or Cost (-) Item Savings(+) Year of Discount Discounted Savings(+) Cost(-)(1) Occur. (2) Factor(3) ings(+)Cost(-)(4) a. b. c. d. Total C Total Non Energy Discounted Savings (3A2+3Bd4) 4. First Year Dollar Savings (2F3+3A+(3Bd1/Economic Life)): \$214 5. Simple Payback (1G/4): 10.61 Years 6. Total Net Discounted Savings (2F5+3C): \$2,571	3. Non Energy S	Savings (+) or Cost	(-):			
(1) Discount Factor (Table A) (2) Discounted Savings/Cost (3A x 3A1) B. Non Recurring Savings (+) or Cost (-) Item Savings(+) Year of Discount Discounted Savings(+) Cost(-)(1) Occur. (2) Factor(3) ings(+)Cost(-)(4) a. b. c. d. Total C Total Non Energy Discounted Savings (3A2+3Bd4) 4. First Year Dollar Savings (2F3+3A+(3Bd1/Economic Life)): \$214 5. Simple Payback (1G/4): 10.61 Years 6. Total Net Discounted Savings (2F5+3C): \$2,571	A Appual Boom	ring (+/-)		\$0.00		
(2) Discounted Savings/Cost (3A x 3A1) \$0 B. Non Recurring Savings (+) or Cost (-) Item Savings(+) Year of Discount Discounted Sav-					11 94	
B. Non Recurring Savings (+) or Cost (-) Item Savings(+) Year of Discount Discounted Savings(+)Cost(-)(1) Occur. (2) Factor(3) ings(+)Cost(-)(4) a.	• • • • • • • • • • • • • • • • • • • •	•	2.4.1.\		11.54	ŝ٥
Item	(Z) Discounted t	Savings/Cost (SA X				40
Cost(-)(1) Occur. (2) Factor(3) ings(+)Cost(-)(4) a. b. c. d. Total C Total Non Energy Discounted Savings (3A2+3Bd4) 4. First Year Dollar Savings (2F3+3A+(3Bd1/Economic Life)): \$214 5. Simple Payback (1G/4): 10.61 Years 6. Total Net Discounted Savings (2F5+3C): \$2,571	B. Non Recurring	g Savings (+) or Co	ost (-)			
Cost(-)(1) Occur. (2) Factor(3) ings(+)Cost(-)(4) a. b. c. d. Total C Total Non Energy Discounted Savings (3A2+3Bd4) 4. First Year Dollar Savings (2F3+3A+(3Bd1/Economic Life)): \$214 5. Simple Payback (1G/4): 10.61 Years 6. Total Net Discounted Savings (2F5+3C): \$2,571	ltama	Consineral ()	Voor of	Discount	Discounted Say	
a. b. c. d. Total C Total Non Energy Discounted Savings (3A2+3Bd4) 4. First Year Dollar Savings (2F3+3A+(3Bd1/Economic Life)): \$214 5. Simple Payback (1G/4): 10.61 Years 6. Total Net Discounted Savings (2F5+3C): \$2,571	item					
b. c. d. Total C Total Non Energy Discounted Savings (3A2+3Bd4) 4. First Year Dollar Savings (2F3+3A+(3Bd1/Economic Life)): \$214 5. Simple Payback (1G/4): 10.61 Years 6. Total Net Discounted Savings (2F5+3C): \$2,571		Cost(-)(1)	Occur. (2)	ractor(3)	ings(+)Cost(-)(4)	
c. d. Total C Total Non Energy Discounted Savings (3A2+3Bd4) 4. First Year Dollar Savings (2F3+3A+(3Bd1/Economic Life)): \$214 5. Simple Payback (1G/4): 10.61 Years 6. Total Net Discounted Savings (2F5+3C): \$2,571	_					
d. Total C Total Non Energy Discounted Savings (3A2+3Bd4) 4. First Year Dollar Savings (2F3+3A+(3Bd1/Economic Life)): \$214 5. Simple Payback (1G/4): 10.61 Years 6. Total Net Discounted Savings (2F5+3C): \$2,571						
C Total Non Energy Discounted Savings (3A2+3Bd4) \$0 4. First Year Dollar Savings (2F3+3A+(3Bd1/Economic Life)): \$214 5. Simple Payback (1G/4): 10.61 Years 6. Total Net Discounted Savings (2F5+3C): \$2,571						
4. First Year Dollar Savings (2F3 + 3A + (3Bd1/Economic Life)): \$214 5. Simple Payback (1G/4): 10.61 Years 6. Total Net Discounted Savings (2F5 + 3C): \$2,571	d. Total					
5. Simple Payback (1G/4): 10.61 Years 6. Total Net Discounted Savings (2F5 + 3C): \$2,571	C Total Non Ene	rgy Discounted Sav	rings (3A2+3Bd4)		\$0	
6. Total Net Discounted Savings (2F5+3C): \$2,571	4. First Year Do	llar Savings (2F3 + 3	BA + (3Bd1/Economi	c Life)):	\$214	
6. Total Net Discounted Savings (2F5+3C): \$2,571	5. Simple Payba	ck (1G/4):			10.61	Years
•			F5 + 3C):	•	\$2,571	
	7. Savings to In	vestment Ratio (SIR	(6/1G):		1.13	

				Date Prepa	ared	Sheet	of
CONSTRUCTION COST ES	AMIT	TE		Nov-94		1	7
Project				Project No.	Basis for E	stimate	
ECIP Facility Energy Improvement				<u> </u>			
Location Western Area Demilitarizati	on Fac	ility (\	VADF)]		
Hawthorne Army Ammunition	n Plan	t, Nev	ada		Code A (n	o design con	npeted)
Engineer-Architect							
Keller & Gannon Drawing No.		Estimat			Ohaalisid B		
Lighting ECO Unit Costs		LSuita	ВІН		Checked B	RCL	
	Qua	ntity	·	bor	M	aterial	T
Line Item	No.	Unit	Per		Per		Total
LD-1. Delamp & Retrofit:	Units	Meas.	Unit	Total	Unit	Total	Cost
LD-1. Delamp & Retront.					ture to onic Ba	a 1-Lam	ס
Pomovo 1 E40T42 Loren & Dia Connector	T	T					T
Remove 1 F40T12 Lamp & Pin Connectors	1 1	EA	\$2.50	\$2.50	\$0.00	\$0.00	\$2.50
Electronic Ballast: 6250-01-353-7722	1 1	EA	\$12.50	\$12.50	\$25.00	\$25.00	\$37.50
F32T8 Lamp: 6240-01-344-9943 or 9508	1 1	EA	\$4.50	\$4.50	\$2.83	\$2.83	\$7.33
Subtotal	- 			\$19.50		\$27.83	\$47.33
Nevada Sales Tax	3.75%	%		-		\$1.04	\$1.04
Subtotal							\$48.37
Contractor OH & Profit	25.0%	%			ļ		\$12.09
Subtotal							\$60.47
Bond	1.5%	%					\$0.91
Subtotal	ļ. <u></u>						\$61.37
Estimating Contingency	10.0%	%					\$6.14
Total Probable Construction Cost	<u> </u>						\$67.51
LD-2. Delamp & Retrofit:						a 2-Lamp)
	7				onic Ba		
Remove 1 F40T12 Lamp & Pin Connectors	2	EA	\$2.50	\$5.00	\$0.00	\$0.00	\$5.00
Electronic Ballast: 6250-01-379-3041	1_1_	EA	\$15.00	\$15.00	\$25.00	\$25.00	\$40.00
F32T8 Lamp: 6240-01-344-9943 or 9508	2	EA	\$3.66	\$7.32	\$2.83	\$5.66	\$12.98
Subtotal				\$27.32		\$30.66	\$57.98
Nevada Sales Tax	3.75%	%		-		\$1.15	\$1.15
Subtotal							\$59.13
Contractor OH & Profit	25.0%	%					\$14.78
Subtotal							\$73.91
Bond	1.5%	%					\$1.11
Subtotal							\$75.02
Estimating Contingency	10.0%	%					\$7.50
Total Probable Construction Cost	L		· · · · · · · · · · · · · · · · · · ·				\$82.52

				Date Prepa	red	Sheet	of
CONSTRUCTION COST ESTIMATE					v-94	2	7
Project				Project No.	Basis for E	lstimate	
ECIP Facility Energy Improveme	ents			,			
Location Western Area Demilitarizati	on Faci	lity (V	VADE)		-		
Hawthorne Army Ammunition					Codo A (n	o design con	anotod)
Engineer-Architect	JI F Iai ii	, 1467	aua		Code A (III	o design con	ipeleuj
Keller & Gannon							
Drawing No.		Estimat	or		Checked B	у	
Lighting ECO Unit Costs			BIH			RCL	
	Quai			bor		aterial	
Line Item	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	Total Cost
LF-1. Exit Light LED Retrofit							
LED Kit: 277V, 6240-01-381-2061	1	EA	\$15.00	\$15.00	\$31.50	\$31.50	\$46.50
Nevada Sales Tax	3.75%	%		-		\$1.18	\$1.18
Subtotal							\$47.68
Contractor OH & Profit	25.0%	%					\$11.92
Subtotal	20.070	- ~			 	<u> </u>	\$59.60
	1.5%	%					\$0.89
Bond	1.5%	70					\$60.50
Subtotal	10.00/	0/			 		
Estimating Contingency	10.0%	%			<u> </u>	<u></u>	\$6.05
Total Probable Construction Cost	<u></u>						\$66.55
LF-2. F40T12, 1 Lamp Fixtures:	•		Electro		Γ8 Lam _l last	os and	
Electronic Ballast: 277V=6250-01-379-3041	1	EA	\$12.50	\$12.50	\$25.00	\$25.00	\$37.50
F32T8 Lamp: 6240-01-344-9943 or 9508	1	EA	\$2.70	\$2.70	\$2.83	\$2.83	\$5.53
Subtotal				\$15.20		\$27.83	\$43.03
Nevada Sales Tax	3.75%	%		-		\$1.04	\$1.04
Subtotal	05.004	0/			ļ	<u> </u>	\$44.07
Contractor OH & Profit	25.0%	%		ļ		<u> </u>	\$11.02
Subtotal	1.5%	%		<u> </u>			\$55.09 \$0.83
Bond Subtotal	1.5%	70		ļ	 		\$55.92
Estimating Contingency	10.0%	%		<u> </u>	 		\$5.59
Total Probable Construction Cost	10.070			l	1		\$61.51
LF-3A. F40T12, 2 Lamp Fixtures:	Renla	cela	mns w	ith F327	Γ8 Lamp	ns and	1 44
(Standard Fixtures)	•		Electro		•		
Electronic Ballast: 277V, 6250-01-379-3041	1	EA	\$15.00	\$15.00	\$25.00	\$25.00	\$40.00
F32T8 Lamp: 6240-01-344-9943 or 9508	2	EA	\$2.50	\$5.00	\$2.83	\$5.66	\$10.66
Subtotal				\$20.00		\$30.66	\$50.66
Nevada Sales Tax	3.75%	%		-		\$1.15	\$1.15
Subtotal							\$51.81
Contractor OH & Profit	25.0%	%					\$12.95
Subtotal							\$64.76
Bond	1.5%	%					\$0.97
Subtotal							\$65.73
Estimating Contingency	10.0%	%					\$6.57
Total Probable Construction Cost	1						\$72.31

Note: Labor costs are based on a subcontractor rate of \$30/hour including burden for electricians.

				Date Prepa	red	Sheet	of
CONSTRUCTION COST ES	TIMA	ГΕ		•	v-94	3	7
Project				Project No.	Basis for E	Istimate	
ECIP Facility Energy Improvement	nts			,			
Location Western Area Demilitarization	n Faci	lity (V	VADE)	<u>!</u>	1		
Hawthorne Army Ammunitio					0-4-8/-	- 	
Engineer-Architect	ITTIAIII	, IVEV	aua		Code A (n	o design cor	npetea)
Keller & Gannon							
Drawing No.		Estimat	or		Checked B	v	
Lighting ECO Unit Costs			BIH			RCL	
	Quai	ntity		bor	Ma	aterial	T
Line Item	No.	Unit	Per		Per		Total
	Units	Meas.	Unit	Total	Unit	Total	Cost
LF-3B. F40T12, 2 Lamp Fixtures:	•		•		Γ8 Lam _l	ps and	
(Industrial Fixtures)	Retro	fit an	Electro	nic Bal	last		
Electronic Ballast:120V=6250-01-379-1917; or	1	EA	\$13.00	\$13.00	\$25.00	\$25.00	\$38.00
Electronic Ballast:277V=6250-01-379-3041							
F32T8 Lamp: 6240-01-344-9943 or 9508	2	EA	\$2.25	\$4.50	\$2.83	\$5.66	\$10.16
Subtotal				\$17.50		\$30.66	\$48.16
Nevada Sales Tax	3.75%	%		-		\$1.15	\$1.15
Subtotal							\$49.31
Contractor OH & Profit	25.0%	%					\$12.33
Subtotal							\$61.64
Bond	1.5%	%					\$0.92
Subtotal							\$62.56
Estimating Contingency	10.0%	%					\$6.26
Total Probable Construction Cost							\$68.82
LF-4A. F40T12, 4 Lamp Fixtures:	Repla	ce La	ımps wi	th F327	Γ8 Lamp	os and	
	Retro	fit Ele	ctronic	Ballas	ts .		
Electronic Ballast:120V=6250-01-379-1917; or	_						
Electronic Ballast: 277V=6250-01-379-3041	2	EA	\$13.00	\$26.00	\$25.00	\$50.00	\$76.00
F32T8 Lamp: 6240-01-344-9943 or 9508	4	EA	\$2.25	\$9.00	\$2.83	\$11.32	\$20.32
Subtotal			,	\$35.00		\$61.32	\$96.32
Nevada Sales Tax	3.75%	%		•		\$2.30	\$2.30
Subtotal							\$98.62
Contractor OH & Profit	25.0%	%				*****	\$24.65
Subtotal							\$123.27
Bond	1.5%	%					\$1.85
Subtotal							\$125.12
Estimating Contingency	10.0%	%					\$12.51
Total Probable Construction Cost				-			\$137.64

Date Prepared Sheet 7 Nov-94 4 CONSTRUCTION COST ESTIMATE Project No. Basis for Estimate Project **ECIP Facility Energy Improvements** Western Area Demilitarization Facility (WADF) Location Hawthorne Army Ammunition Plant, Nevada Code A (no design competed) Engineer-Architect Keller & Gannon Estimator Checked By Drawing No. BIH **Lighting ECO Unit Costs** RCL Quantity Labor Material Per Line Item Total Total Unit Total Units Meas. Unit Cost Retrofit Reflector, Delamp to 3 each F32T8 LF-4B. F40T12, 4 Lamp Fixtures: Lamps and an Electronic Ballast Electronic Ballast:120V=6250-01-364-2997; or \$17.50 \$36.44 \$36.44 EΑ \$17.50 \$53.94 277V=6250-01-364-2998 3 F32T8 Lamp: 6240-01-344-9943 or 9508 EA \$2.25 \$6.75 \$2.83 \$8.49 \$15.24 Reflector Retrofit for Delamping: R302-348T8 1 EΑ \$6.00 \$6.00 \$49.00 \$49.00 \$55.00 SSB 2'x4' for 3xF32T8 Subtotal \$24.25 \$44.93 \$69.18 Nevada Sales Tax 3.75% % \$1.68 \$1.68 \$70.86 Subtotal Contractor OH & Profit 25.0% % \$17.71 \$88.57 Subtotal % 1.5% \$1.33 Bond \$89.90 Subtotal 10.0% % \$8.99 **Estimating Contingency Total Probable Construction Cost** \$98.89 LF-5. 100W Incandescent Fixture: Replace Fixture with DTT 26W Compact Fluorescent Lamp, Base and Ballast \$0.00 \$7.50 \$7.50 Remove Existing Incandescent Fixture EA \$0.00 \$7.50 1 EΑ \$6.00 \$6.00 \$0.89 \$0.89 \$6.89 Advance (or Equal) L-1Q26TP Ballast Adaptor Base: 26 Watt, G240-3, 1 EA \$2.50 \$2.50 \$5.79 \$5.79 \$8.29 6250-01-352-1529 DTT 26W, 2700K CRI 82 Compact \$2.50 \$2.50 \$7.23 \$7.23 \$9.73 1 EA Fluorescent Lamp: 6240-01-345-9535 \$32.40 Subtotal \$18.50 \$13.90 Nevada Sales Tax 3.75% % \$0.52 \$0.52 \$32.92 Subtotal Contractor OH & Profit 25.0% % \$8.23 Subtotal \$41.15 % Bond 1.5% \$0.62 Subtotal \$41.77

Joseph (

Note: Labor costs are based on a subcontractor rate of \$30/hour including burden for electricians.

10.0%

%

\$4.18

\$45.95

Estimating Contingency

Total Probable Construction Cost

ents ion Faci on Plant				v-94 Basis for E	5	7
ents ion Faci					L	
ion Fac	lity (V		Project No.		etimata	-
ion Fac	lity (V			Dasis for E	Suriace	
	ility (v	VADE)	l	1		
on Plani	NI.	-				
	, nev	aua		Code A (no	o design con	npeted)
	Estimat	or		Checked B	v	
					•	
Qua	ntity		bor	Ma		ı
No.	Unit	Per		Per		Total
	·	L		<u> </u>	1	Cost
Repla	ce Fi	xture w	ith DTT	26W C	ompact	
Fluor	escer	nt Lamp	, Base	and Bal	last	
1	EA	\$7.50	\$7.50	\$0.00	\$0.00	\$7.50
1	EA	\$6.00	\$6.00	\$0.89	\$0.89	\$6.89
1	EA	\$2.50	\$2.50	\$5.79	\$5.79	\$8.29
		20.50	40.50	47.00	47.00	
1	EA	\$2.50	\$2.50	\$7.23	\$7.23	\$9.73
			\$18.50		\$13.90	\$32.40
3.75%	%		-		\$0.52	\$0.52
						\$32.92
25.0%	%					\$8.23
						\$41.15
1.5%	%					\$0.62
		ļ				\$41.77
10.0%	%	<u> </u>				\$4.18
D-4	F14	U. FO 141	- 44 11' - 1			\$45.95
			•		ıre	
						1 .
	<u>EA</u>	\$27.00	\$27.00	\$53.02	\$53.02	\$80.02
1 1	EA	\$9.00	\$9.00	\$23.95	\$23.95	\$32.95
		,				<u> </u>
0.750/	0/		\$36.00			\$112.97
3./5%	%		-		\$2.89	\$2.89
25.00/	0/					\$115.86
25.0%	70					\$28.96
1 50/	0/_					\$144.82 \$2.17
1.576	/0					\$146.99
10.0%	%					\$140.99
1.0.078	//			Ii		\$161.69
	No. Units Repla Fluore 1 1 1 1 1 3.75% 25.0% 1.5% Retro Sodiu 1 1 3.75% 25.0% 1.5% 1.5%	Quantity No. Unit Meas. Replace Fi Fluorescer 1	No. Unit Per Unit Replace Fixture w Fluorescent Lamp 1	Replace Fixture with DTT	BIH Quantity Labor Max No. Unit Per Unit Total Unit Unit Total Unit BIH RCL Quantity Labor Material No. Unit Per Unit Total Replace Fixture with DTT 26W Compact Fluorescent Lamp, Base and Ballast 1	

				Date Prepa	red	Sheet	of
CONSTRUCTION COST ES	FAMIT	Έ		Nov-94		6	7
Project				Project No.	Basis for E	stimate	
ECIP Facility Energy Improvement	ents						
Location Western Area Demilitarizat		lity (V	VADF)				
Hawthorne Army Ammunition			=		Code A (ne	o design com	peted)
Engineer-Architect	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	,					,
Keller & Gannon							
Drawing No.		Estimat	or		Checked B	у	
Lighting ECO Unit Costs	BIH			RCL			
	Quar			bor		aterial	
Line Item	No.	Unit	Per	Total	Per Unit	Total	Total Cost
L F Q 400M/88// Firstrum	Units	Meas.	Unit		gh Pres		Cost
LF-8. 400W MV Fixture:					_	Suit	
(Explosion Proof Fixtures)					Ballast		
Ballast, 250W S-50: 6250-01-348-6629	1	EA	\$27.60	\$27.60	\$78.38	\$78.38	\$105.98
HPS Lamp 250W ANSI S-50 E-28 Coated:	1	EA	\$9.00	\$9.00	\$27.40	\$27.40	\$36.40
6240-01-094-8332			*****		V	l	
Subtotal				\$36.60		\$105.78	\$142.38
Nevada Sales Tax	3.75%	%		-		\$3.97	\$3.97
Subtotal							\$146.35
Contractor OH & Profit	25.0%	%					\$36.59
Subtotal							\$182.93
Bond	1.5%	%					\$2.74
Subtotal							\$185.68
Estimating Contingency	10.0%	%		L	<u> </u>		\$18.57
Total Probable Construction Cost							\$204.25
LC-1. Occupancy Sensor Control:					Infrared		
	Senso	or (co	nferenc	e rooms	& large	offices)	
Occupancy Sensor: PIR or Ultra Sonic	1	EA	\$34.29	\$34.29	\$86.00	\$86.00	\$120.29
Sensor Transformer Pack	1	EA	\$24.00	\$24.00	\$30.00	\$30.00	\$54.00
Wiremold Raceway & 3/C #18 Wire	25	LF	\$2.38	\$59.50	\$0.65	\$16.25	\$75.75
Subtotal				\$59.50		\$132.25	\$250.04
Nevada Sales Tax	3.75%	%		-		\$4.96	\$4.96
Subtotal							\$255.00
Contractor OH & Profit	25.0%	%					\$63.75
Subtotal							\$318.75
Bond	1.5%	%					\$4.78
Subtotal							\$323.53
Estimating Contingency	10.0%	%					\$32.35
Total Probable Construction Cost							\$355.88

				Date Prepa	red	Sheet	of
CONSTRUCTION COST ES	FAMIT	ΓΕ		Nov-94		7	7
Project				Project No.	Basis for E	stimate	
ECIP Facility Energy Improveme	nts						
Location Western Area Demilitarizati	on Faci	lity (V	VADF)		1		
Hawthorne Army Ammunition					Code A (n	o design con	npeted)
Engineer-Architect	711 1 102110	,			100007.		.p,
Keller & Gannon							
Drawing No.		Estimat	or		Checked B	у	
Lighting ECO Unit Costs			BIH			RCL	
	Quar	ntity		ibor	M	aterial	
Line Item	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	Total Cost
LC-2. Occupancy Sensor Control:						for use i	<u> </u>
20 2. Occupancy Conce. Consen	•	-	and Toi				
Occupancy Sensor: PIR or Ultra Sonic	1	EA	\$34.29	\$34.29	\$86.00	\$86.00	\$120.29
Sensor Transformer Pack	1	EA	\$24.00	\$24.00	\$30.00	\$30.00	\$54.00
Wiremold Raceway & 3/C #18 Wire	25	LF	\$2.38	\$59.50	\$0.65	\$16.25	\$75.75
Subtotal				\$59.50		\$132.25	\$250.04
Nevada Sales Tax	3.75%	%		-		\$4.96	\$4.96
Subtotal							\$255.00
Contractor OH & Profit	25.0%	%					\$63.75
Subtotal							\$318.75
Bond	1.5%	%					\$4.78
Subtotal							\$323.53
Estimating Contingency	10.0%	%					\$32.35
Total Probable Construction Cost							\$355.88
LC-3. Occupancy Sensor Control:	Auton	natic	Wall Sv	vitch Pa	assive l	nfrared	
	(PIR)	Sens	or for S	maller (Office A	reas	
Occupancy Sensor: PIR or Ultra Sonic	1 1	ΕA	\$9.99	\$9.99	\$64.00	\$64.00	\$73.99
Subtotal				\$9.99		\$64.00	\$73.99
Nevada Sales Tax	3.75%	%		-		\$2.40	\$2.40
Subtotal							\$76.39
Contractor OH & Profit	25.0%	%					\$19.10
Subtotal							\$95.49
Bond	1.5%	%					\$1.43
Subtotal							\$96.92
Estimating Contingency	10.0%	%					\$9.69
Total Probable Construction Cost							\$106.61

DGSC The Supplier of Choice

Energy ficient Lighting

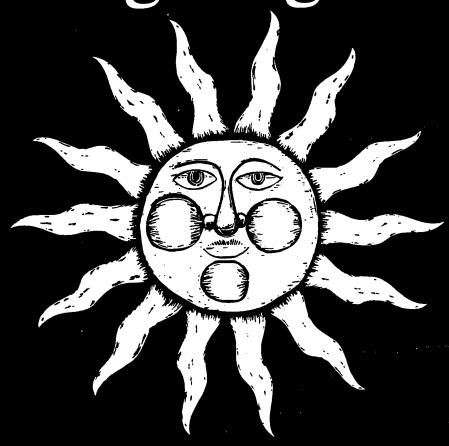
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Environment.

The Dividends

Will Last a

Lifetime."





DEFENSE GENERAL SUPPLY CENTER Richmond, Virginia

1-800-DLA BULB

FEBRUARY 1994



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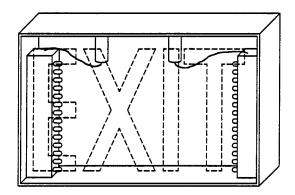
We appreciate your business!

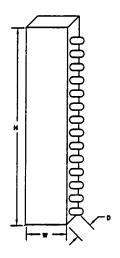


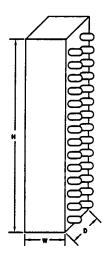
LED Exit Sign Retrofit Kits

•1.8 - 3.6 input Watts/Fixture. (Replaces standard 20-25 watt lamps.)

- Convert existing incandescent EXIT signs to use energy efficient LED light strips.
- Each kit contains two LED light strips and a reflective backing to provide even light distribution and a new red lens for the fixture.
- · Estimated life is 25 years.
- · Complies with OSHA and NFPA requirements.
- · Available in four base styles to fit existing sockets or as a hard wire kit.
- LED light strips emit a bright red light and are not recommended for use with green signs.
- In addition to DGSC standard warranty, manufacturer's 25 year warranty applies.
- UL approved.







Statement of the Land of the Land of the Land	and delayer the St. Bloomer	himman trade (territorial district) [1] a fait district
SIDIAL, BASE	The second second	TS NATIONAL WITH SET.
Act All Street		TS NATIONAL STOCKNINGER

SINGL	SINGLE FACE KITS								
	DIM: 6" H X 7/8" W X 3/4" D , each strip.								
1.8	DC BAY	120	6240-01-381-1658						
1.8	INTERMEDIATE	120	6240-01-381-1702						
1.8	CANDELABRA	120	6240-01-381-1843						
1.8	MEDIUM	120	6240-01-381-1589						
1.8	HARD WIRE	120	6240-01-381-1957						
1.8	HARD WIRE	277	6240-01-381-2061						

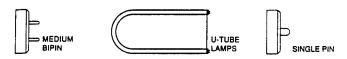
Information provided by Computer Power Inc. Astralite Divison.

HILLIAL BASE BURNERS VOLIS MATIONAL
MATTS TO THE PROPERTY OF THE P
TOTAL BASE VOLTS NATIONAL STOCK NUMBER

DOUB	DOUBLE FACE KITS									
DIM: 6" H X 7/8" W X 1 1/2" D , each strip.										
3.6	DC BAY	120	6240-01-381-1594							
3.6	INTERMEDIATE	120	6240-01-381-1633							
3.6	CANDELABRA	120	6240-01-381-1695							
3.6	MEDIUM	120	6240-01-381-1552							
3.6	HARD WIRE	120	6240-01-381-1818							
3.6	HARD WIRE	277	6240-01-381-1940							

Fluorescent Lamps

PASE INTELLIBRITION I



PREHE	PREHEAT									
F15T8										
Т8	MED BIPIN		18	WARM WHITE, CRI 52	860	7500	6240-00-800-4668			
	W.E.D D.I. 114		10	COOL WHITE, CRI 62	825	7500	6240-00-152-2982			
F20T12										
T12	MED BIPIN		24	WARM WHITE, CRI 52	1250	9000	6240-00-299-7250			
112	IVIED BIFIN		24	COOL WHITE, CRI 62	1200	9000	6240-00-152-2996			
F40CW/P	H/ES (Energy Sa	ving Replace	nent for	F40CW/PH, 40W lamp)						
T12	MED BIPIN		48	COOL WHITE, CRI 62	2700	15000	6240-01-344-9524			

T-8 LA	MPS						***************************************
F25T8 A	ND F32T8 (Use \	With T-8 Elec	tronic or N	flagnetic Ballasts)	····		
				3000K, CRI 80, (CG)	2250	20000	6240-01-364-6963
			36	3500K, CRI 80, (CG)	2250	20000	6240-01-364-6964
				4100K, CRI 80, (CG)	2250	20000	6240-01-364-6965
				3000K, CRI 70	2850	20000	6240-01-344-9535
T8	MED BIPIN			3500K, CRI 70	2850	20000	6240-01-344-9536
	,		48	4100K, CRI 70	2850	20000	6240-01-344-9537
			40	3000K, CRI 85, (CG)	3050	20000	6240-01-344-9943
				3500K, CRI 85, (CG)	3050	20000	6240-01-344-9508
				4100K, CRI 85, (CG)	3050	20000	6240-01-344-9507
T-9 LAMI	PS (USE WITH T-	8 ELECTRO	NIC, T-8 M	AGNETIC, OR T-12 ELECTRONIC BALLAS	IT)		
				4200K, CRI 82, (CG)	2750°	24000	6240-01-367-0690
Т9	MED BIPIN	30/34	48	5000K, CRI 85, (CG)	2750°	24000	6240-01-367-0691
				5500K, CRI 91, (CG)	2350*	24000	6240-01-367-0692
T-8 U-TU	BES (Use With T	-8 Electronic	or Magne	tic Ballast)			
				3100K, CRI 70, 1 5/8" LEG SPACING	2800	20000	6240-01-353-7706
			22.5	3500K, CRI 70, 1 5/8" LEG SPACING	2800	20000	6240-01-353-7707
			22.5	4100K, CRI 70, 1 5/8" LEG SPACING	2800	20000	6240-01-353-7708
T8	MED BIPIN			5000K, CRI 80, 1 5/8" LEG SPACING	2600	20000	6240-01-373-2687
				3500K, CRI 75, 6" LEG SPACING	2600	20000	6240-01-378-7585
			22.5	4100K, CRI 75, 6" LEG SPACING	2600	20000	6240-01-378-7711
			EE.J	3500K, CRI 85, 6" LEG SPACING	2600	20000	6240-01-378-8043
				4100K, CRI 85, 6" LEG SPACING	2600	20000	6240-01-378-7575
F96T8 (U	SE WITH F96T8 I	BALLAST)					
				3500K, CRI 75	5700	15000	6240-01-382-0105
Т8	SINGLE PIN	201	96	4100K, CRI 75	5700	15000	6240-01-382-0108
. •	J		50	3500K, CRI 85	6000	15000	6240-01-382-0111
				4100K, CRI 85	6000	15000	6240-01-382-0118

(CG) Cathode Guard is a device designed t\(\hat{d}\) reduced end darkening of the lamp.

All operating and physical characteristics f\(\hat{p}\) items in this section were provided by the manufacturer's of these products.

Electronic Fluorescent Ballasts

AMP TYPE VOLTS FOF LAMPS INPUT BALLAST MIN START THE NATIONAL STOCK

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watt of a ballast utilizing efficacy pecause

ost elecse units ications istalled. ectronic lychlorinents of

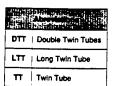
class P
est, the supply at ature extended in all lectronic mass.

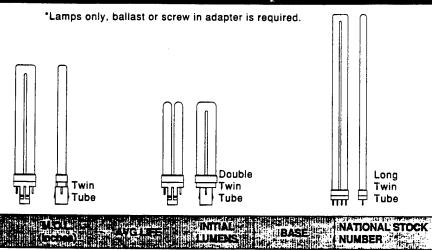
			WATIS	FACTOR (%)	TEMP		NUMBER	
T. FO SHIPEUR	Start Ball	- anner de manden		FE	onding U-Tube la			
ा <u>र्वे स्ट्रिक्ट</u> स्ट्रिक्ट स्ट्रिक्ट	il Horather	1	31	85-92	50	<10%-15%	6250-01-353-7722	
		2	61	85-92	50	1 4 <10%	6250-01-379-1917	
	120	3	88	93	0	10%	6250-01-364-2997	
		4	112	91	50	20%	6250-01-364-2999	
		1	31	85-92	50	1556	6250-01-353-7723	
		2	60	85-92	50	1 1 10%	6250-01-379-3041	
	277	3	88	93	0	<10%	6250-01-364-2998	
		4	112	91	50	<10%	6250-01-365-0987	
		1 or	38	110		<25%		
		2	62	95	50	<20%	6250-01-361-6016	
	1	1(B1) or	36	110		<20%		
F32T8; can also be used	120	120	2	62	95	0	<15%	6250-01-364-8906
with F25T8 or F17T8 lamps.		3 or	90	95				
•		4	112	85	50	<20%	6250-01-361-6018	
		3	90	93	0	<20%	6250-01-377-5785	
		4	114	91	50	<20%	6250-01-364-8902	
		1 or	38	110		<25%		
		2	62	95	50	<20%	6250-01-361-6017	
		1(B1) or	36	110		<20%		
		2	62	95	0	<15%	6250-01-364-8908	
	277	3 or	90	95	50	<20%	6250-01-381-4451	
		4	112	85	50	<20%	0230-01-361-4431	
		3	90	90	0	<20%	6250-01-377-5788	
		4	114	91	50	<20%	6250-01-364-8904	
instant	Start Bell		9618 lampe					
F96T8	120		118	92	50	<20%	6250-01-377-7376	
	277	2	118	92	50	<20%	6250-01-381-4453	

⁽B1) Not recommended for 1 lamp F17T8 lamp.

All operating characteristics for items in this section were provided by the manufacturer's of these products.

Compact Fluorescent Lamps*





TWIN TUE	BE LAMPS						
	TT	2700K, CRI 82	4.125	10000	250	G23	6240-01-344-9531
15	ग	4100K, CRI 85	4.125	10000	250	G23	6240-01-352-0432
177.15	π	2700K, CRI 82	5.3125	10000	400	G23	6240-01-306-8247
17.11	TT	3500K, CRI 82	5.3125	10000	400	G23	6240-01-352-0433
	TT	4100K, CRI 85	5.3125	10000	400	G23	6240-01-352-0434
19.18	π	2700K, CRI 82	6.5	10000	600	G23	6240-01-344-9532
	TT	3500K, CRI 82	6.5	10000	600	G23	6240-01-352-0435
	ŤĪ	4100K, CRI 85	6.5	10000	600	G23	6240-01-352-0436
	П	2700K, CRI 85	7.4375	10000	900	G23	6240-01-344-9533
	Т	3500K, CRI 85	7.4375	10000	900	G23	6240-01-353-7759
	TI	4100K, CRI 85	7.4375	10000	900	G23	6240-01-352-0437
OUBLE	TWIN TUBE	LAMPS			**		
ini 🗮 🔭	DTT	2700K, CRI 82	4.4	10000	575	G23-2	6240-01-383-4126
the second	DTT	3500K, CRI 85	4.4	10000	575	G23-2	6240-01-383-4135
	DTT	2700K, CRI 82	5.8	10000	900	GX23	6240-01-345-2252
	DTT	3500K, CRI 82	5.8	10000	900	GX23	6240-01-352-0438
2	DTT	4100K, CRI 85	5.8	10000	900	GX23	6240-01-383-4202
	DTT	2700K, CRI 82	6.8	10000	1250	G24d	6240-01-345-2251
	TTG	3500K, CRI 85	6.8	10000	1200	G24d	6240-01-352-0439
	דוָם	4100K, CRI 82	6.8	10000	1250	G24d	6240-01-352-0440
	DTT	2700K, CRI 82	7.6	10000	1800	G24d	6240-01-345-9535
	DTT	3500K, CRI 82	7.6	10000	1800	G24d	6240-01-353-7760
	DTT	4100K, CRI 82	7.6	10000	1800	G24d	6240-01-352-0441
ONG TWI	N TUBE LA	AMPS			*		
	LTT	3000K, CRI 82	22.5	20000	3150	2G11	6240-01-353-7703
	LTT	3500K, CRI 82	22.5	20000	3150	2G11	6240-01-353-7704
in the last of the	LTT	4100K, CRI 82	22.5	20000	3150	2G11	6240-01-353-7705

All operating and physical characteristics for items in this section were provided by the manufacturer's of these products.

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• Ma • UL

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SC

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Compact Fluorescent Lamp Holders

8.9 Twin Tube Lamp

6.2 Double Twin Tube

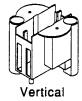
	LAMP WATTAGE AND BASE	
HORIZONTAL	5, 7 OR 9 WATT, G23 BASE	6250-01-352-1526
SCREW-MOUNT	13 WATT, GX23 BASE	6250-01-352-1527
	5,7 OR 9 WATT, G23 BASE	6250-01-353-4469
VERTICAL	13 WATT, GX23 BASE	6250-01-353-4470
SCREW-MOUNT	18 WATT, G240-2 BASE	6250-01-352-1528
	26 WATT, G240-3 BASE	6250-01-352-1529

2.3



0

2.4



6250-01-381-6840

All operating and physical characteristics for items in this section were provided by the manufacturer's of these products.

13 Watt Adapter, use with

13W twin tube or 13W

double twin tube lamps.

32

33

34

32

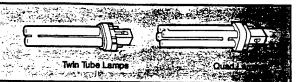
135

759 137

439 440 535

441

703 704 705



Lamp Data		Min.	·		Electric	ai Data			Wiring	Shipp	ing Data
Description Watts	(Volts)	Starting Temp. (°F.)	Catalog Number ((All Class P)†	Notes	Line Current (Amps)	Watts Loss	Sound Rating	(Pages	Diagram	Othical	Weight Std. Ctn. (Lbs.)

One Lamp—Encapsulated Ballasts—Normal Power Factor -

(1) PL 5, F5TT,	_	120	0	L-1B9-TP	2	.170	3	A3 S2 41122 60 45
(1) Dulux S5	5	277	0	VL-1B9-TP		.180	7	A 7-Hz 31125 30 35
(1) PL 7, F7TT, (1) F7BX,	7	120	0	L-1B9-TP	2	.170	3	A 52 112 60 45
(1) Dulux S7		277	0	VL-1B9-TP		.180	7	A 12 112 30 35
(1) PL 9, (1) F9TT & DTT,	9	120	25	L-1B9-TP	2	.170	3	At \$2 112 60 45
(1) F9BX, (1) Dulux 9 Sⅅ		277	0	VL-1B9-TP		.180	7	A R2 7,172 30 35
(1) PLC 10, (1) Dulux D10	10	120	0	L-1Q13-TP	2	.385	6	A F-4 108 20 40
(1) PL 13, PLC 13 USA, (1) F13TT & DTT,	13	120	32	L-1B13-TP	2	.300	4	4A 5 2 1 60 45
(1) F13 BX, (1) Dulux 13 Sⅅ		277	0	VL-1B13-TP		.300	8	A 2 2 30 35
(1) PLC 13, (1) Dulux D13, (1) F13T5	13	120	0	L-1Q13-TP	2	.360	5	1 20 40
(1) Thorn 2D16, (1) PLC 18, (1) Dulux D18	16 18 18	120 277	50	L-1Q18-TP VL-1Q18-TP	2	.530 .22	7 5	108 20 40 55 30 50
(1) PLC 26, (1) Dulux D26, (1) Thorn 2D28	26	120 277	50	L-1Q26-TP VL-1Q26-TP	2	.660 .32	9 7	G-108 20 40 F2 12 30 50

One Lamp—Encapsulated Ballasts—High Power Factor & Power Factor Corrected

(1) PL 5, F5TT,	5	120	25	H-1B9-TP	2	.100	2	A 12 S2 11 60 40
(1) Dulux S5	,	277	0	VH-1B9-TP		.070	7	A 1872 3011 30 34
(1) PL 7, F7TT, (1) F7BX,	7	120	0	H-1B9-TP	2	.100	3	A S2 3 11 60 40
(1) Dulux S7		277	0	VH-1B9-TP		.070	6	A 12 30 35
(1) PL 9, (1) F9TT & DTT,	9	120	25	H-1B9-TP	2	.100	3	A 60 40
(1) F9BX, (1) Dulux 9 Sⅅ		277	0	VH-1B9-TP		.070	7	A 11 30 35
(1) PL 13, PLC 13 USA, (1) F13TT & DTT	13	120	32	H-1B13-TP	2	.150	4	A 152 111 60 45
(1) F13BX (1) Dulux 13 Sⅅ		277	0	VH-1B13-TP		.090	8	A
(1) PLC 16	16	120	50	H-1Q16-TP	2	.165	3.5	A R2 111 30 35
(1) PLC 18	18	120 277	50	H-1Q18-TP VH-1Q18-TP	2	.19 .09	4 6	75 20 40 40 F2 111 30 50
(1) PLC 22	22	120	32	H-1Q22-TP	2	.220	4	AN SER SALTS 30 40
(1) PLC 26	26	120 277	50	H-1Q26-TP VH-1Q26-TP	2	.31 .13	8 7	111 20 40 1112 30 50
(1) PLC 28	28	120	32	H-1Q28-TP	2	.300	5	H2 F111 30 40

NOTES:

2. CSA Approved.

†Ordering Information: Units shown are furnished with Class P ADVAN-guard® Automatic Resetting Thermostat. Units packed in Individual Cartons—Add suffix—I.

AMPS

High Pressure Sodium Lamps

\sim	Э	/	$\overline{}$	\cap				
() B-17) E-	18	E-23 1/2	E-28 ED-28		E-37 ED-37		
ED-17	e Ec	D-18	ED-23 1/2	E-25 BT-28		BT-37		
WATE	BASE	BURNING				MEAN		NATIONAL
1999年日1991年	dang.ing	POSITION	al Pilmoner		LUMENS	LUMENS	LIFE	STOCK NUMBER
35W,		T		CLEAR	2250	2025	16000	6240-01-344-9548
MSIS-76	MEDIUM	ANY	B-17	COATED	2150	1935	16000	6240-01-182-1895
							10000	0240 07-102-1000
	MEDIUM	ANY	B-17	CLEAR	4000	3600	24000	6240-01-143-4812
50W,	WILDIGIVI	ANI	D-17	COATED	3800	3420	24000	6240-01-182-1894
14 SI S-68	MOGUL	ANY	E-23 1/2	CLEAR	4000	3600	24000	6240-01-198-3896
	WIOGOL	ANT	E-23 1/2	COATED	3800	3420	24000	6240-01-228-9595
LANCE LANGE		1	1					
	MEDIUM	ANY	ED-17	CLEAR	6300	5670	24000	6240-01-142-8453
70W,			1	COATED	5950	5050	24000	6240-01-344-9549
MSI S-62	MOGUL	ANY	E-23 1/2	CLEAR	6300	5450	24000	6240-01-198-3897
				COATED	5860	5050	24000	6240-01-095-5421
			T	CLEAR	. 0500	0550	04000	5040.04.000.0040
	MEDIUM	ANY	B-17	COATED	9500	8550	24000	6240-01-299-6342
100W,				CLEAR	8800	7920	24000	6240-01-344-9550
	MOGUL	ANY	E-23 1/2	COATED	9500 8800	8550	24000	6240-01-049-2871
			<u> </u>	JOORIED	8800	7920	24000	6240-01-094-2279
				CLEAR	16000	14400	24000	6240-01-142-8452
	MEDIUM	ANY	B-17	COATED	15000	13500	24000	6240-01-344-9551
50V,				CLEAR	16000	14400	24000	6240-01-080-9620
1515-55	MOGUL	ANY	E-23 1/2	COATED	15000	13500	24000	6240-01-094-2280
				CLEAR, STANDBY ARC TUBE	16000	14400	24000	6240-01-344-9552
150W,	MOGUL	ANY	E-28/BT-28	ICLEAR	16000	14400	24000	6240-01-344-9964
#St.S-56					10000	14400		0240-01-044-0304
EXCOV.	MOGUL	ANY	ED-18	CLEAR	22000	19800	24000	6240-01-178-9113
WSLS-66								0240-01-170-3110
			E-18/BT-18	CLEAR	27500	24750	24000	6240-00-551-3098
2004	MOGUL	ANY	E-28	COATED	26000	23400	24000	6240-01-094-8332
			E-18/BT-18	CLEAR, STANDBY ARC TUBE	27500	24750	24000	6240-01-344-9965
11 -11111 Ni ma				· · · · · · · · · · · · · · · · · · ·				
1 S 57	MOGUL	ANY	ED-18	CLEAR	37000	33300	24000	6240-01-344-9966
anno-								
			ED-18	CLEAR	50000	45000	24000	6240-00-099-6764
	MOGUL	ANY	BT-37	COATED	47500	42750	24000	6240-01-233-1093
			E-18	CLEAR, STANDBY ARC TUBE	50000	45000	24000	6240-01-345-9536
· istis				i	L			
BOW,	MOGUL	ANY	E-25	CLEAR	140000	126000	24000	6240-01-051-2557
1 11	- INCOUL		E-25	CLEAR,STANDBY ARC TUBE	140000	126000	24000	6240-01-344-9968
				·				

Standby Arc Tube: Allows the lamp to reignite immediately following a power interuption.

-86

87

All operating and physical characteristics for items in this section were provided by the manufacturer's of these products.

3ALLASTS

High Intensity Discharge (HID) Ballasts

	ABBREVIATIONS:
AR	Autotransformer Reactor: 2 Core System
CWA	Constant Wattage Autotransformer
нх	High Reactance
R	Reactor
HPF	High Power Factor (90% Min.)
NPF	Normal Power Factor (45-60%)
PFC	Power Factor Corrected (75-89%)

i3 i3 i9 i0

30 51 ---

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;80****

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Most HID ballasts are supplied as replacement kits. Each kit contains the following:

- · Core and Coil Ballast
- · Capacitor and Starter (if needed)
- Mounting Brackets
- · Installation Instructions

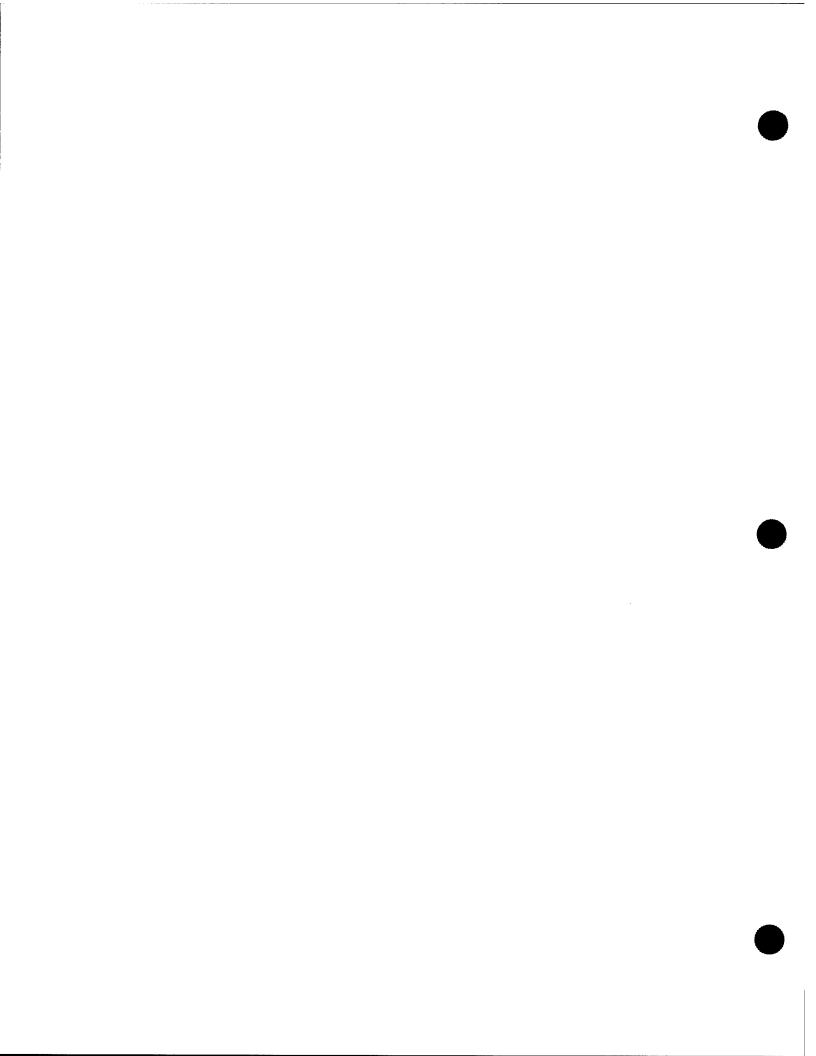
High Pressure Sodium Ballast Kits							
AMPWATTS		INPUT WATTS	INPUT CURRENT	CAPACITANG (mkg)	CIRCUIT	# OF LAMPS	NATIONAL STOCK
35W, S-76	120	46	0.65	14	R-HPF	1	6250-01-348-6626
25 00W, 0-70	120/277	55	1.0	14	AR-PFC	1	6250-01-348-6627
	120	62	0.95	20	R-HPF	1	6250-01-348-3134
50W, S-68	120/277	80	1.3/0.55	20	AR-PFC	1	6250-01-348-6628
	MV	64	0.58/0.33/0.29/0.25	5	HX-HPF	1	6250-01-348-6632
70W, S-62	MV	88	1.45/0.85/0.75/0.65	7	HX-HPF	1	6250-01-348-5696
100W, S-54	MV	130	2.2/1.27/1.1/0.85	10	HX-HPF	1	6250-01-348-5324
150W, S-56	MV	200	3/1.65/1.45/1.25	14	HX-HPF	1	6250-01-198-6054
150W,S-55	MV	188	1.75/1.0/0.88/0.75	20	CWA	1	6250-01-352-8004
200W, S-66	MV	245	2.25/1.3/1.2/1	28	CWA	1	6250-01-348-5325
250W, S-50	MV	300	2.75/1.6/1.38/1.2	35	CWA	1	6250-01-348-6629
310W, S-67	MV	365	3.4/1.95/1.7/1.45	45	CWA	1	6250-01-348-6631
400W, S-51	MV	457	3.9/2.25/1.95/1.7	55	CWA	1	6250-01-348-6630
1000W, S-52	MV	1100	9.5/5.5/4.8/4.2	26	CWA	1	6250-01-348-7439

MV = MULTI VOLTAGE (120/208/240/277)

		Near Inc	candescent Qu	ality HPS B	allasts		
WATTS	VOLTS	WATTS.	INPUT CURRENT	CAPACITANC (rufd)	E CIRCUIT	# OF	NATIONAL STOCK
cludes ballast with inte	egral ignitor, ca	pcitor for NPF co	orrection and 120/277	v transformer whe	ere applicable.		
S-99	120/277	50	0.40	20	HYBRID	1	6250-01355-2262
7.S-104	120/277	70	0.57	28	HYBRID	1	6250-01-355-2263
The state of the s		440	4.05				
2 44 22	120	118	1.25		ELEC.	1	6250-01-355-2265

All operating and physical characteristics for items in this section were provided by the manufacturer's of these products.

EEAP Energy Survey of Army Industrial Facilities Western Area Demilitarization Facility, HWAAP, Nevada APPENDIX I **Compressed Air System Modification Evaluations** F:\PROJ\1640316\WORD\ARMY_IND.SRV 941209_____



EEAP Energy Survey of Army Industrial Facilities Western Area Demilitarization Facility, HWAAP, Nevada

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Proposed Compressed Air System Repairs and Energy Savings Options	3
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Compressed Air System Modification Evaluations

Compressed air is provided from the central plant, Building 117-2, to WADF facilities. Three air compressors are connected in parallel to the distribution system which is partly above and partly below ground. The system is shown schematically on Figure I-1.

Existing compressors are deteriorated; in fact, only one was operational at the time of field investigations. Run-time meters installed on each compressor indicate that the systems have been operated for only a fraction of their ages. The following data were observed:

Air Compressor 1	9,893 Hours, total run-time	18 years old
Air Compressor 2	10,999 Hours, total run-time	18 years old
Air Compressor 3	19,122 Hours, total run-time	18 years old

Much higher run times are expected for 18-year old machines; on the order of 50,000 total hours or more.

Compressed air from the central plant, Plant Air, is distributed to WADF buildings at about 115 psig. Plant Air is used as motive force in HVAC system damper actuators and for process uses.

In most mechanical rooms, Plant Air and instrument air systems have been interconnected. This was done to retain control in the event of a central plant shutdown; however, interconnections have remained open. This has lead to contamination of sensors and controls which are not designed for even the small amounts of oil found in Plant Air. System interconnections should be removed. HVAC control system retrofit calculations provided in Appendix D assume replacement of existing pneumatic control systems with DDC controls, effectively eliminating the need for instrument compressed air service. Plant Air is still required to provide motive force for damper actuators and other control devices.

Existing air compressors are in need of complete overhauls. Replacement of the existing air compressors and ancillary equipment (oil and air coolers and refrigerated air dryers) should be considered.

Based on manufacturers catalog data, performance of the existing plant air compressors is as follows:

Compressor Nameplate Data:

Ingersoll-Rand Model: PA150	S/N:	96076U76859
-----------------------------	------	-------------

Motor: 200 HP Operating. Pressure: 115 psig

Full Load Capacity at 100 psig: 680 Actual Cubic Feet per Minute (ACFM)

Full Load BHP at 100 psig: 150 BHP

Compressor Efficiency: 22.06 BHP/100ACFM

Motor Efficiency: 92.5%

Compressor Power Consumption Measurement:	96%	PF
(Averages of three measurements)	135.3	RLA
(wordgoo or amoo more and mor	484	Volts, 3 Phase
680 CFM	108.9	kW based on measurement
680 CFM	121.0	kW based on nameplate data

Refrigerated Air Dryer One air dryer is installed, as shown on Figure I-1, for each air compressor.

Nameplate Data: Ingersoll-Rand Model No. MN 14, S/N: 14D0576002, 3 and 4

Model 14 performance data is not available, however, Ingersoll-Rand Model Nos. 11 & 12 performance is:

	575 CFM @ 440 VAC 11.0 A 0.96 PF =	8.05	kW, or
	Model 11	1.40	kW / 100 SCFM
Model 12:	700 CFM @ 440 VAC 13.5 A 0.96 PF =	9.88	kW, or
	Model 12	1.41	kW / 100 SCFM
	Assume Model 14 has the same performance:	1.40	kW / 100 SCFM
	Thus, at 680 CFM, the electrical demand is:	9.5	kW

Operating Problems:

Operators at Building 117-6 state that when sludge presses at 117-6 & 117-7 are dumped, the air pressure at Buildings 117-5 & 117-8 drops. All systems except manipulators run at 15 psig. Manipulators at building 117-5 & 117-8 require at least 80 psig compressed air to operate.

Significant plant air leaks were found at Building 117-6 (oil separator glass broken) and at Building 117-11 (top of the conveyor hopper from Building 117-10). Overall, leaks appear to constitute a hole of about 3/8" in diameter. The leakage rate is calculated as follows:

Mass Flow Rate Calculation:

$$p_1/RT_1 = (105 + 14.7) psig x 144 in^2/SF + (53.3 x (460 + 85)) = 0.5934 lf/ft^3$$

Critical
$$(p_2/p_1) = (2/(k+1))^{k/(k-1)} = (2.0/2.4)^{1.40/0.40} = 0.528$$

Since this latter ratio is less than the critical pressure ratio, the pressure of the escaping gas = $0.528 \times p_1$. Hence $p_2 = 0.528 \times 119.7 = 63.2$ psia

$$V_2 = c_2 =$$
Square Root (1.4 x 32.2 x 53.3 x T_2) = Square Root (2402.764 T_2)

where
$$T_2/T_1 = (p_2/p_1)^{(k-1)/k} = (0.528)^{0.40/1.40} = 0.833$$
, then $T_2 = 454$ °R

Then
$$V_2$$
 = Square Root (2402.764 x 454) = 1,045 Ft/Sec

This air leakage rate, 192 ACFM is 28.3% of a single air compressor's capacity, and is probably the reason for the operating problems addressed above.

Present Compressed Air System Power Consumption

Without considering process compressed air consumption, the air leakage rate calculated above consumes: 195,588 kWH per year of electric power. Calculated as follows:

(Measured Compressor kW + Refrigerated Air Dryer kW) x (% of Compressor Capacity Devoted to Leaks) x

Hours per Year of Operation

Process compressed air consumption is assumed to require operation of compressors for 5 additional hours per day now, constituting about 184,756 kWH per year of additional power consumption, for a total 380,345 kWH per year of compressed air system power use.

Estimates for future use are based on 2 compressors operating 8 hours per day 6 days per week. The longer operating hours per day allow for operation of WADF at closer to its capacity.

Proposed Compressed Air System Repairs and Energy Saving Options

Energy Saving Opportunities

Proposed energy conservation opportunities for the compressed air system (refer to Appendix A, Energy Engineering Analysis Program Study and Criteria Review, Table 3-1, ECO No. 8.) included suggestions to lower the compressed air pressure and increase storage volume. Neither approach is technically feasible at WADF. Manipulators in the Refining and Mechanical Removal buildings require at least 80 psig; the pressure must be maintained high enough at the central plant (building 117-2) in order to provide the required pressure at the point of use (building 117-8), farthest from the plant. Storage volume could be increased, however, this would only result in reducing cycle frequency for the system, a problem that should be cleared up by fixing air leaks.

Repairs Required

Existing air compressors need rebuilding and renovation due to their inactivation for a number of years. Two of the three air compressors are currently undergoing repairs, and are partially disassembled. It is assumed that all three existing compressors require "air-end" rebuilds and control system renovations. Based on discussions with an Ingersoll-Rand representative, budget cost for such a rebuild can be expected to require \$8,000 to \$10,000 for the air-end rebuild with an additional \$2,000 to \$3,000 for on-site labor and materials for installation and control system renovation. Bare cost per unit for air-end rebuilds and control system repairs is, thus: \$13,000 ; total for 3 units is = \$39,000

Repairs are required for the Building 117-6 oil separator glass and the Building 117-11 conveyor hopper air valve to stop air leaks which presently constitute the largest compressed air load on the system.

Repairing leaks alone will save about:

195,588 kWH per year

\$8,558 per year savings

The following proposed system modifications are considered assuming this renovation & repair expense is avoided.

Replacement Options for Air Compressors and Air Dryers

The existing PA150 air compressors are rated to produce 680 ACFM at 19.19 kW / 100 ACFM. Three compressors are installed, two operating and one spare. A single compressor currently carries the load, however, most of the WADF buildings are not presently operating. Replacement options consider providing the same capacity of compressed air service as was originally installed.

Alternative 1: Replace Existing System with Ingersoll-Rand Model SSR XFE300-2S and Desiccant Air Dryer

Capacity ,thus, performance of the proposed air compressor is reduced by 15% for the desiccant air dryer. A desiccant air dryer requires about 15% of the compressor output for regeneration of the desiccant. Desiccant air dryers are available with only about 7% purge requirements; however, electric heating elements are installed to compensate for the reduced compressed air supply.

Presently, two PA150 air compressors can provide about 1,360 ACFM of 100 psig air. Allowing for the loss of 15% of the capacity for use in desiccant air dryers, about 1,600 ACFM at 100 psig is required. Based on catalog data, an Ingersoll-Rand two stage rotary screw air compressor, model number SSR XFE300-2S, is selected as a replacement air compressor.

Operating parameters are:

1,602 ACFM at 100 psig, one 300 HP Motor of 95.2% efficiency Modern controls allow air volume provided to modulate with demand.

A desiccant air dryer is provided to replace the existing refrigerated air dryers. The desiccant dryer uses essentially no power, relying on compressed air for desiccant recharging. Two desiccant columns are provided to allow one in operation while the other is being recharged.

The rotary screw air compressor is air cooled. Costs are allowed for ducting fresh outside air into and out of the air compressor for cooling purposes. This allows the existing air/oil coolers located outside building 117-2 to be removed from service.

Energy savings and economic analysis results are summarized on Table I-1. Costs associated with this proposed retrofit include: Cost of the new air compressor and desiccant air dryer, ductwork required for cooling air and avoided costs of repairing the three existing air compressors and refrigerated air dryer sets. Backup compressed air service is assumed available from instrument air compressors located in each of the WADF building mechanical rooms.

Alternative 2: Replace Existing System with Ingersoll-Rand Model SSR XFE250-2S, use Existing Refrigerated Air Dryers

This alternative is similar to Alternative 1 presented above, except existing refrigerated air dryers are to be retained in service rather than installing desiccant air dryers. Because the desiccant air dryers are not to be installed, the compressor need not have as high a capacity. Consequently, an Ingersoll-Rand Two-Stage Rotary Screw Air Compressor, Model SSR XFE250-2S is selected.

Operating parameters are:

1,355 ACFM at 100 psig, one 250 HP Motor of 95.2% efficiency Modern controls allow air volume provided to modulate with demand.

Energy savings and economic analysis results are summarized on Table I-1. Costs associated with this proposed retrofit include: Cost of the new air compressor and repair or replacement of the existing refrigerated air dryers and avoided costs of repairing the three existing air compressors. Backup compressed air service is assumed available from instrument air compressors located in each of the WADF building mechanical rooms. These compressors are currently interconnected with the Plant Air system and will be deenergized as a result of DDC control retrofits proposed for building HVAC systems.

Alternative 3: Replace Existing System with Two Ingersoll-Rand Model LL5 and Desiccant Air Dryer

This proposed replacement option is similar to the Alternative 1 described above. It is proposed to replace the three existing Ingersoll-Rand PA 150 air compressors with two Ingersoll-Rand LL5 reciprocating air compressors and desiccant air dryers. The LL5 line of air compressors is water cooled, thus, a cooling water system is required for each of the air compressors.

Operating parameters are:

Two LL5 Reciprocating, Water Cooled Air Compressors, each delivering 810 ACFM at 100 psig, one 150 HP Motor each of 92.5% efficiency.

The desiccant air dryer requires 15% of the compressed air produced, thus, the compressors are oversized to allow for desiccant regeneration. The existing air/oil coolers located outside building 117-2 are removed from service.

Energy savings and economic analysis results are summarized on Table I-1. Costs associated with this proposed retrofit include: Cost of the new air compressors and desiccant air dryers and avoided costs of repairing the three existing air compressors and refrigerated air dryer sets. Backup compressed air service is assumed available from instrument air compressors located in each of the WADF building mechanical rooms. These compressors are currently interconnected with the Plant Air system and will be deenergized as a result of DDC control retrofits proposed for building HVAC systems.

Alternative 4: Replace Existing System with Ingersoll-Rand Model LL5 Reciprocating Air Compressors, use Existing Refrigerated Air Dryers

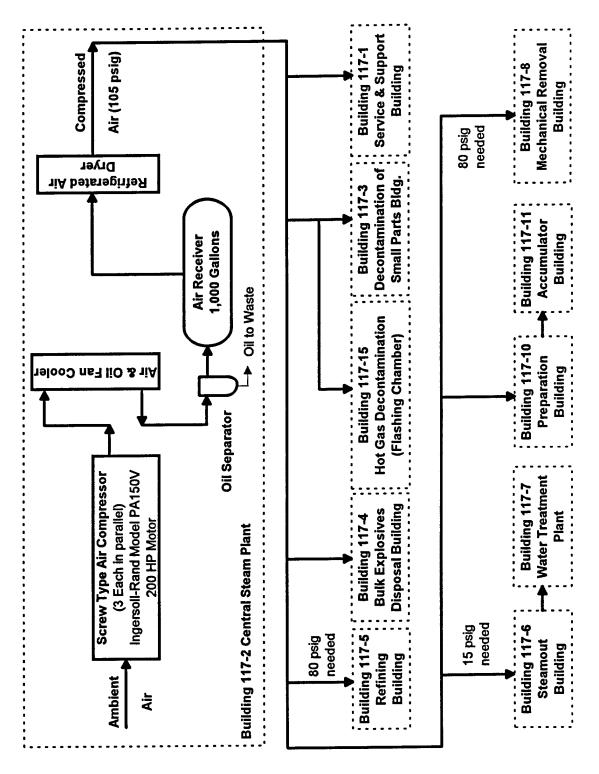
This alternative is similar to Alternative 3, the LL5 air compressor alternative presented above, except existing refrigerated air dryers are to be retained in service; desiccant air dryers are not to be installed. Because the desiccant air dryers are not to be installed, the replacement compressors need not have as high capacities. Consequently, two 125 HP Ingersoll-Rand LL5 reciprocating air compressors are selected. The LL5 line of air compressors is water cooled, thus, a cooling water system is required for each of the air compressors.

Operating parameters are:

Two LL5 Reciprocating, Water Cooled Air Compressors, each delivering 634 ACFM at 100 psig, one 125 HP Motor each of 92.5% efficiency.

Energy savings and economic analysis results are summarized on Table I-1. Costs associated with this proposed retrofit include: Cost of the new air compressors and repair or replacement of the existing refrigerated air dryers and avoided costs of repairing the three existing air compressors. Backup compressed air service is assumed available from instrument air compressors located in each of the WADF building mechanical rooms. These compressors are currently interconnected with the Plant Air system and will be deenergized as a result of DDC control retrofits proposed for building HVAC systems.

Figure I-1. WADF Compressed Air Distribution System Schematic Diagram



Air Days G	Capacity	Capacity Connected	Eq. Hours	Power		kWH/Yr	Elec Saved	\$007	Investment	
Complessor & All Dryer Description	ACFM	×	per Year	kWH/Yr	kW Saved	Saved	\$/Year	Saved	•	SIR
Existing Installation: (values indicated based on 2 operating,	ased on 2	7	standby)					Assumed		
3 x I-R PA150 Air Compressors, and	1,360	242	1,662	441,308	ı	•	1	20 Year	•	•
3 x I-R MN14 Refrigerated Air Dryers	Total	19		195,588				Compressor	Ļ	
3 x Aftercooler / Oil Cooler (Exterior)		4.5	See Note 1 See Note2	See Note2				Lifetime		
Alternative 1: Replacement I-R MN SSR XFE300-2S and Do	R XFE300-	2S and Desi	esiccant Air Dryer	/er						
1 x I-R SSR XFE300-2S Compressor	1,602	224	1,660	371,566	41.7	265,330	\$15,868	\$239,297	\$239,297 \$182,761	1.63
1 x Desiccant Air Dryer (requires 15% of compressor output for regeneration)	compresso	r output for re	generation)					Pa)	Payback Years =	10.04
Alternative 2: Replacement I-R SSR XFE250-2S with Exist	FE250-2S v	with Existing	ing Refrigerated Air Dryers	d Air Drye	S					
1 x I-R SSR XFE250-2S Compressor	1,355	187	1,668	342,937	59.9	293,959	\$18,987	\$286,329	\$286,329 \$166,795	1.86
2 x I-R MN14 Extg. Refr. Air Dryers	Total	19						Pa	Payback Years =	8.52
Alternative 3: Replacement I-R MN LL5 and Desiccant Air	5 and Desi	ccant Air Dryer	/er				·			
2 x I-R LL5 Air Compressors 150 HP	1,620	224	1,642	379,686	34.2	257,211	\$14,751	\$222,442	\$222,442 \$235,684	1.15
2 x Cooling Systems (Water Cooling)		7						Pay	Payback Years =	14.40
2 x Desiccant Air Dryers (require 15% of compressor outputs f	compresso	r outputs for I	or regeneration)	_						
Alternative 4: Replacement I-R MN LL5 with Existing Refri	5 with Exis	ting Refrige	igerated Air Dryers	/ers						
2 x I-R LL5 Air Compressors 125 HP	1,268	187	1,783	379,768	48.0	257,129	\$16,156	\$243,632	\$243,632 \$240,202	1.05
2 x Cooling Systems (Water Cooling)		7						Pay	Payback Years =	15.24
2 x I-R MN14 Extg. Refr. Air Dryers	Total	19								

Operating hours for proposed replacement options are adjusted to provide the same amount of compressed air as the existing PA 150 compressors. Note 1: Operating hours per year assume that the air compressors are operating 33% of the scheduled WADF operating hours (16 hours/day, 6 days/week). Note 2: Power consumption due to leaks in the existing system is added to the "base case" and repair costs are expensed for each alternative.

Recommended Option: Replace air compressors with Ingersoll-Rand Model SSR XFE250-2S 2-stage rotary screw air compressor, use existing refrigerated air dryers F:PROJ/1640316/ENGRICOMP-AIR.XLS Table 1

Location:	Hawthorne Army Western Area De		nt Region No. 4 lity (WADF), Nevada					
Project Title:	ECIP Facility Ener		ressors with Ingers		Y96 SSR			
	XFE300-2S 2-Sta	ge Rotary Screw	Air Compressor an	d Desiccant Air	Dryer			
Analysis Date:		Economic Life: 2		Preparer: KELL	ER & GANNON			
1. Investment			\$163,180					
A. Constructio	n Costs							
B. SIOH			\$ 9,791 \$ 9,791					
C. Design Cos								
D. Total Cost			\$ 182,761	40				
-	ue of Existing Equi			\$0	_			
	y Company Rebate			\$0	-			
G. Total Invest	G. Total Investment (1D-1E-1F) \$182,761							
2. Energy Savings (+)/Cost(-): Date of NISTIR 85-3273 Used for Discount Factors: October 1994								
Date of NISTIF	R 85-3273 Used fo	r Discount Factor	rs: October 1994					
Energy	Cost	Saving	Annual \$	Discount	Discounted			
Source	\$/MBTU(1)	MBTU/Yr(2)	Savings(3)	Factor(4)	Savings(5)			
300100	7/11/21 0(17	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	our mg o (o)	• •	-			
A. Elec.	\$12.82	906	\$11,609	15.08	\$175,065			
B. Dist	\$6.13		\$ 0	18.57	\$ 0			
C. LPG	-	-						
D. Other		-						
E. Elec Deman	d \$102.21	41.7 k	W \$4,259	15.08	\$64,232			
F. Total		906	\$15,868		\$239,297			
r. 10tai 500 \$15,500 \$250,25,								
3. Non Energy Savings (+) or Cost (-):								
A. Annual Rec	urring (+/-)		(\$2,448)					
(1) Discount Factor (Table A)								
• •	Savings/Cost (3A	x 3A1)			(\$36,422)			
(2) Discounted	Odvings/Cost (CA	X OATT						
B. Non Recurri	ing Savings (+) or	Cost (-)						
Item	Savings(+)	Year of	Discount	Discounted				
	Cost(-)(1)	Occur. (2)	Factor(3)	Savings(+) Cos	st(-) (4)			
•	\$95,528	0	1.000	\$95,528				
a. L	- 433,320							
b.								
c.				AOF 520				
d. Total	\$95,528			\$95,528				
C Total Non E	nergy Discounted S	Savings (3A2 + 3E	3d 4)	\$59,106				
4 First Vaar F	Inlar Savings (2F3	+ 3A + (3Bd1/Yes	ars Economic Life)):	\$18,197				
5. Simple Payl		(0.001)1100		10.04	Years			
•	iscounted Savings	12E5 + 3C1.		\$298,403				
				1.63				
7. Savings to	Investment Ratio (oin) 0/10:		1.00				

Project No.

Hawthorne Army Ammunition Plant Region No. 4

Location:

Project Title:	ECIP Facility Ener	gy Improvements	lity (WADF), Nevad ressors with Ingers Air Compressor, u	Fiscal Year F coll-Rand Model								
Analysis Date:		Economic Life: 2		Preparer: KELL								
1 Investment	Coate											
1. Investment A. Constructio			\$148,924									
B. SIOH	ii Custs		\$ 8,935									
C. Design Cos	+		\$ 8,935									
_			\$ 166,795									
D. Total Cost		nmont	\$ 100,733	\$O								
-	ue of Existing Equi y Company Rebate			\$O								
					_ \$166,795							
G. Total invest	tment (1D-1E-1F)				¥100,700							
2. Energy Savi	ngs (+)/Cost(-):											
Date of NISTIF	R 85-3273 Used fo	or Discount Factor	rs: October 1994									
_		0. 1	Amount A	Discount	Discounted							
Energy	Cost	Saving	Annual \$	Discount	Savings(5)							
Source	\$/MBTU(1)	MBTU/Yr(2)	Savings(3)	Factor(4)	29A1182(2)							
A. Elec.	\$12.82	1,003	\$12,862	15.08	\$193,954							
B. Dist	\$6.13	1,000	\$O	18.57	\$0							
C. LPG			***									
D. Other		•										
E. Elec Deman	d \$102.21	59.9 k	W \$6,126	15.08	\$92,375							
F. Total		1,003	\$18,987		\$286,329							
1,000 4.0,007												
3. Non Energy Savings (+) or Cost (-):												
	4 . 43		(62.224)									
A. Annual Rec	_		(\$2,234)	14.88								
(1) Discount Factor (Table A)14.88												
(2) Discounted	Savings/Cost (SA	X 3A1)			(400,240)							
B. Non Recurri	ng Savings (+) or	Cost (-)										
Item	Savings(+)	Year of	Discount	Discounted								
	Cost(-)(1)	Occur. (2)	Factor(3)	Savings(+) Co	st(-) (4)							
a.	\$56,470	0	1.000	\$56,470								
b.												
С.												
d. Total	\$56,470	4		\$56,470								
C Total Non Er	nergy Discounted S	Savings (3A2+3E	3d4)	\$23,231								
4 First Vear D	ollar Savings (2F3	+ 3A + (3Bd1/Yes	ars Economic Life)):	\$19,577								
5. Simple Payl		. 5 ,555 . , 100		8.52	Years							
	iscounted Savings	(2F5 + 3C)·		\$309,560								
	-			1.86								
7. Javings to I	iivosunciil NauU (J 17 U. 10.			7. Savings to Investment Ratio (SIR) 6/1G: 1.86							

Life Cycle Cost Analysis Summary Energy Conservation Investment Program (ECIP)

Location: Hawthorne Army Ammunition Plant Region No. 4 Project No. Western Area Demilitarization Facility (WADF), Nevada										
Project Title:	Project Title: ECIP Facility Energy Improvements Fiscal Year FY96									
•			pressors with Ingers	oll-Rand Model I	LL5 &					
		siccant Air Dry								
Analysis Date:	March 1995	Economic Life:	20 Years	Preparer: KELLE	R & GANNON					
1. Investment			4040 400							
A. Constructio	n Costs		\$210,432							
B. SIOH			\$ 12,626							
C. Design Cos			\$ 12,626							
D. Total Cost			\$ 235,684	40						
_	ue of Existing Equi	pment		\$0	-					
	y Company Rebate			\$0	- 622E 604					
G. Total Invest	tment (1D-1E-1F)				\$235,684					
2. Energy Savi	ings (+)/Cost(-):		0-1-11004							
Date of NISTIF	R 85-3273 Used fo	r Discount Facto	ors: October 1994							
Energy	Cost	Saving	Annual \$	Discount	Discounted					
Source	\$/MBTU(1)	MBTU/Yr(2)	Savings(3)	Factor(4)	Savings(5)					
Source	4/MB10(1)	111010/11(2)	ourgo(c)							
A. Elec.	\$12.82	877.9	\$11,254	15.08	\$169,708					
B. Dist	\$6.13		\$ 0	18.57	\$ O					
C. LPG	-	-								
D. Other	-	-								
E. Elec Deman	d \$102.21	34.2	kW\$3,497	15.08	\$52,734					
F. Total	-	878	\$14,751		\$222,442					
3. Non Energy	Savings (+) or Co	st (-):								
			/62 1ES\							
A. Annual Rec	_		(\$3,156)	14.88						
• •	actor (Table A)	. 0.4.43		14.00	(\$46,968)					
(2) Discounted	Savings/Cost (3A	X 3A1)			(440,500)					
P. Non Pooreri	ing Savings (+) or	Cost (-)								
D. Non Necum	ing Savings (+) or	Cost (-)								
Item	Savings(+)	Year of	Discount	Discounted						
TCIII	Cost(-)(1)	Occur. (2)	Factor(3)	Savings(+) Cos	st(-) (4)					
а.	\$95,528	0	1.000	\$95,528						
b.	+00,020									
C.										
d. Total	\$95,528			\$95,528						
u. Iotai	435,520			.00,0=0						
C Total Non E	nergy Discounted S	avings (3A2+3	Bd4)	\$48,560						
4. First Year D	ollar Savinos (2F3	+ 3A + (3Bd1/Ye	ears Economic Life)):	\$16,371						
5. Simple Payl		•		14.40	Years					
• •	iscounted Savings	(2F5 + 3C):		\$271,001						
	Investment Ratio (1.15						
,. Javings to	mirodinone nado h	, .,								

Life Cycle Cost Analysis Summary Energy Conservation Investment Program (ECIP)

Location: Hawthorne Army Ammunition Plant Region No. 4 Project No. Western Area Demilitarization Facility (WADF), Nevada										
Project Title:										
Alternative 4: Replace Air Compressors with Ingersoll-Rand Model LL5, use										
		cisting dryers								
Analysis Date:	: March 1995	Economic Life:	20 Years	Preparer: KELL	ER & GANNON					
1. Investment	Costs									
A. Construction	on Costs		\$214,466							
B. SIOH			\$ 12,868							
C. Design Cos	t		\$ 12,868 <u></u>							
D. Total Cost	(1A+1B+1C)		\$ 240,202							
E. Salvage Val	lue of Existing Equi	pment		\$ 0						
F. Public Utilit	y Company Rebate			\$0						
	tment (1D-1E-1F)				\$240,202					
G. 10ta00					·					
2 Energy Savi	ings (+)/Cost(-):									
		y Discount Easts	ors: October 1994							
Date of Mishi	1 65-3273 0360 10	n Discount i acto	ns. October 1554							
F	Coot	Soving	Annual \$	Discount	Discounted					
Energy	Cost	Saving		Factor(4)	Savings(5)					
Source	\$/MBTU(1)	MBTU/Yr(2)	Savings(3)	ractor(4)	29Augs(2)					
A. Elec.	\$12.82	878	\$11,250	15.08	\$169,653					
B. Dist	\$6.13		\$0	18.57	\$0					
	30.13		40	10.07	70					
C. LPG	-	-								
D. Other		40.0	LW 64.006	15.08	672 979					
E. Elec Deman	st \$102.21		kW \$4,906	15.06	\$73,979					
F. Total		878	\$16,156		\$243,632					
3. Non Energy	Savings (+) or Co	st (-):								
			(40.047)							
A. Annual Rec	-		(\$3,217)	44.00						
	actor (Table A)			14.88	(4.47.000)					
(2) Discounted	I Savings/Cost (3A	x 3A1)			(\$47,869)					
B. Non Recurri	ing Savings (+) or	Cost (-)								
Item	Savings(+)	Year of	Discount	Discounted						
	Cost(-)(1)	Occur. (2)	Factor(3)	Savings(+) Co	st(-) (4)					
a.	<u>\$56,470</u>	0	1.000	<u> \$56,470</u>						
b.										
c.										
d. Total	\$56,470			\$56,470						
	•									
C Total Non E	nergy Discounted S	Savings (3A2+3	Bd4)	\$8,602						
		3 - 1	•	· · · · · · · · · · · · · · · · · · ·						
4. First Year D	ollar Savinos (2F3	+ 3A + (3Bd1/Ye	ars Economic Life)):	\$15,763						
5. Simple Payl	. -			15.24	Years					
•	iscounted Savings	(2E5 ± 3C):		\$252,234						
	=			1.05						
7. Savings (0 i	IIIAGƏTI IIGIIC LIQTIQ (7. Savings to Investment Ratio (SIR) 6/1G: 1.05								

				Date Prepare	d	Sheet	of
CONSTRUCTION CO	March-95 1		1				
Project No.						imate	
ECIP Facility Energy Impr	ovemer	its					
Location Western Area Demili	tarizatio	n Facil	ity (WAD	F)			
Hawthorne Army Amn	nunition	Plant.	Nevada	•	Code A (no	design compe	ted)
Engineer-Architect					1		
Keller & Gannon							
Drawing No.		Estimator			Checked By		
			BIH			RCL	·
	Qua	intity	L	abor	Ma	aterial	1
Line Item	No.	Unit	Per		Per		Total
	Units	Meas.	Unit	Total	Unit	Total	Cost
Repair / Rebuild Costs for Bot	h Com	oresso	rs and R	Refrigerat	ed Air Dr	yers	
Ingersoll-Rand PA150 Compressor	1 1	EA	į.	luded	\$10,000	\$30,000	\$30,000
Air-End Rebuild	3	EA	inc	iuueu	\$10,000	\$30,000	400,000
Replace/Repair Refrigerated Air	3	EA	Inc	luded	\$8,991	\$26,974	\$26,974
Dryers, Ingersoll-Rand MN14					10,000		,
Ingersoll-Rand PA150 Compressor	3	EA	inc	luded	\$3,000	\$9,000	\$9,000
Controls Repairs & Renovation						CCE 074	\$65,974
Subtotal	0.5504	- 01	inc	luded		\$65,974 \$2,474	\$2,474
Nevada Sales Tax	3.75%	%				\$2,474	\$68,448
Subtotal	25.0%	%	 				\$17,112
Contractor OH & Profit	25.0%	70					\$85,560
Subtotal	4.50/	%			 		\$1,283
Bond	1.5%	%					\$86,844
Subtotal				ļ			\$8,684
Estimating Contingency	10.0%	<u>%</u>	L	<u></u>	<u> </u>	<u> </u>	\$95,528
Total Probable Construction (399,526
Repair / Rebuild Costs for Air	Compr	essors	Only				<u> </u>
Ingersoll-Rand PA150 Compressor	3	EA	Inc	luded	\$10,000	\$30,000	\$30,000
Air-End Rebuild							
Ingersoll-Rand PA150 Compressor	3	EA	Inc	luded	\$3,000	\$9,000	\$9,000
Controls Repairs & Renovation			Included		+	\$39,000	\$39,000
Subtotal	0.75%	0/	Included		-	\$1,463	\$1,463
Nevada Sales Tax	3.75%	%	 	-		ψ1, 4 03	\$40,463
Subtotal	1				 		\$10,116
Contractor OH & Profit	25.0%	<u>%</u>	 	ļ		 	
Subtotal				 			\$50,578 \$750
Bond	1.5%	<u>%</u>			_		\$759
Subtotal							\$51,337
Estimating Contingency	10.0%	%	<u> </u>	L		<u> </u>	\$5,134
Total Probable Construction (Cost						\$56,470

	Date Prepared Sheet		Sheet	of			
CONSTRUCTION COS	Marc	March-95					
Project	Project No.	Basis for Es	timate				
ECIP Facility Energy Impr	oveme	nts					
Location Western Area Demili	OF)						
Hawthorne Army Amm		Code A (no	design comp	eted)			
Engineer-Architect	···				1		
Keller & Gannon							
Drawing No. Compressed Air Syste	m	Estimator			Checked By		
Replacement with SSR Compr	essor		B. I. Ho	rst		R. C. Len	nig
	Qu	antity	L	abor	Ma	iterial	
Line item	No.	Unit	Per		Per		Total
	Units	Meas.	Unit	Total	Unit	Total	Cost
Alternative 1: Replacement S	SR XF	E300-2	S Air Co	oled Air (Compres	sor &	
Desiccant Air D					•	_	
Ingersoll-Rand SSR XFE300-2S Two			64.000	64.000	£05 000	\$05,000	600 202
Stage Rotary Screw Air Compressor	1	EA	\$4,282	\$4,282	\$85,000	\$85,000	\$89,282
Heatless Desiccant Air Dryer, Ingersoll	1	EA	\$761.84	\$762	\$18,390	\$18,390	\$19,152
Rand HRD60 (1700 CFM)	<u>'</u>	2	W/ 01.04	47.02	410,000	410,000	410,102
Cooling Air Supply and Exhaust	1	Job	\$2,678	\$2,678	\$1,500	\$1,500	\$4,178
Ductwork thru Building Wall							· ·
Repair of Compressed Air Leaks	1	Job	\$169	\$169	\$200	\$200	\$369
Subtotal	0.750/			\$7,891	ļ	\$105,090	\$112,981
Nevada Sales Tax	3.75%	%	ļ	-		\$3,941	\$3,941 \$116,922
Subtotal Contractor OH & Profit	25.0%	%	 				\$29,231
Subtotal	23.070	78	 		1		\$146,153
Bond	1.5%	%	 			· · · · · · · · · · · · · · · · · · ·	\$2,192
Subtotal	1.570	70	 		<u> </u>		\$148,345
	10.0%	%		<u> </u>			\$14,835
Estimating Contingency Total Probable Construction C		70	<u> </u>	<u> </u>	<u> </u>	L	\$163,180
		= 200 2	C Air Co	alad Air (`amproc	cor 8	\$100,100
Alternative 2: Replacement S		E300-2	S All CO	oled All (ompres	501 Ot	
Desiccant Air D	ryer			I	T	1	
Stage Rotary Screw Air Compressor	1	EA	\$4,040	\$4,040	\$68,000	\$68,000	\$72,040
Replace/Repair Refrigerated Air						200.074	200.074
Dryers, Ingersoll-Rand MN14 or equal	3	EA	Inc	Included		\$26,974	\$26,974
Cooling Air Supply and Exhaust	1	Job	\$2,510	\$2,510	\$1,200	\$1,200	\$3,710
Ductwork thru Building Wall	'	300	,		L		
Repair of Compressed Air Leaks	1	Job	\$169	\$169	\$200	\$200	\$369
Subtotal				\$6,719		\$96,374	\$103,094
Nevada Sales Tax	3.75%	%		-		\$3,614	\$3,614
Subtotal							\$106,708
Contractor OH & Profit	25.0%	%					\$26,677
Subtotal							\$133,385
Bond	1.5%	%			<u> </u>		\$2,001
Subtotal							\$135,385
Estimating Contingency	10.0%	%					\$13,539
Total Probable Construction C	ost						\$148,924

For Life Cycle Cost Analysis, assume existing air compressors and refrigerated air dryer repairs must be performed. These costs are expensed year "0" in the Life Cycle Cost Analysis Summary. \$95,528

Annual O&M expenses are assumed equal to 1.5% of the construction costs per year:

Option with Desiccant Air Dryers: \$2,448 per year.
Option with existing Refrigerated Air Dryers: \$2,234 per year.

				Date Prepare	d	Sheet	of
CONSTRUCTION COST ESTIMATE					March-95 2		2
	<u> </u>	1 11417		Project No.	Basis for Es	timate	
Project ECIP Facility Energy Impr	nveme	nte		1 10,000			
	1						
Location Western Area Demili		Diant	Novoda	,	Code A Inc	design compe	ated)
Hawthorne Army Amm	unition	Plant,	Nevaua		COUE A (IIO	design comp	iteuj
Keller & Gannon							
Drawing No. Compressed Air Syste	m	Estimator			Checked By		
Replacement with LL5 Compre		Lauriano	B. I. Ho	rst	,	R. C. Len	nia
Replacement with LL5 Compre		l			14	iterial	l
		antity	 	abor	 	T T	Total
Line Item	No.	Unit	Per		Per	l -	
	Units	Meas.	Unit	Total	Unit	Total	Cost
Alternative 3: Replacement L	L5 Wat	er Coc	led Air (Compress	ors & De	esiccant A	ir Dryers
Ingersoll-Rand LL5 Air Compressor to	2	EA	\$6,423	\$12,846	\$45,000	\$90,000	\$102,846
Replace Existing PA 150 Compressor			40,720	ļ,			
Heatless Desiccant Air Dryer, Ingersoll	2	l ea	\$304.74	\$609	\$9,623	\$19,246	\$19,855
Rand HRD (600 CFM)			***				
Cooling Water System for I-R LL5 Air	2	EA	\$1,427	\$2,855	\$10,000	\$20,000	\$22,855
Compressor		1-6	6460	\$169	\$200	\$200	\$369
Repair of Compressed Air Leaks	1	Job	\$169_	\$16,480	\$200	\$129,446	\$145,926
Subtotal Nevada Sales Tax	3.75%	%		\$10,400		\$4,854	\$4,854
Subtotal	3.7370	- ⁷⁰			 	4 1,75 5	\$150,780
Contractor OH & Profit	25.0%	%					\$37,695
Subtotal	20.070						\$188,475
	1.5%	%	 				\$2,827
Bond Subtotal	1.570	- ~					\$191,302
	10.0%	%	 		 		\$19,130
Estimating Contingency Total Probable Construction (70		<u> </u>	<u> </u>	l	\$210,432
		1.5	h Friedi	- Dofrie	protod Ai	r Dryers	
Alternative 4: Replacement I-	KMNI	LS WII	n Existii	ig Kenigi	T	Diyers	Γ
Ingersoil-Rand LL5 Air Compressor to Replace Existing PA 125 Compressor	2	EA	\$6,423	\$12,846	\$42,750	\$85,500	\$98,346
Cooling Water System for I-R LL5 Air Compressor	2	EA	\$1,503	\$3,005	\$10,000	\$20,000	\$23,005
Replace/Repair Refrigerated Air Dryers, Ingersoll-Rand MN14	3	EA	Included		\$8,991	\$26,974	\$26,974
Repair of Compressed Air Leaks	1	Job	\$169	\$169	\$200	\$200	\$369
Subtotal				\$16,021	ļ	\$132,674	\$148,695
Nevada Sales Tax	3.75%	%				\$4,975	\$4,975
Subtotal					<u></u>		\$153,670
	25.0%	%					\$38,418
Contractor OH & Profit	25.070						1
	25.0%						\$192,088
Subtotal		%					\$192,088 \$2,881
Subtotal Bond	1.5%						
Subtotal							\$2,881

For Life Cycle Cost Analysis, assume existing air compressors and refrigerated air dryer repairs must be performed. These costs are expensed year "0" in the Life Cycle Cost Analysis Summary.

\$95,528

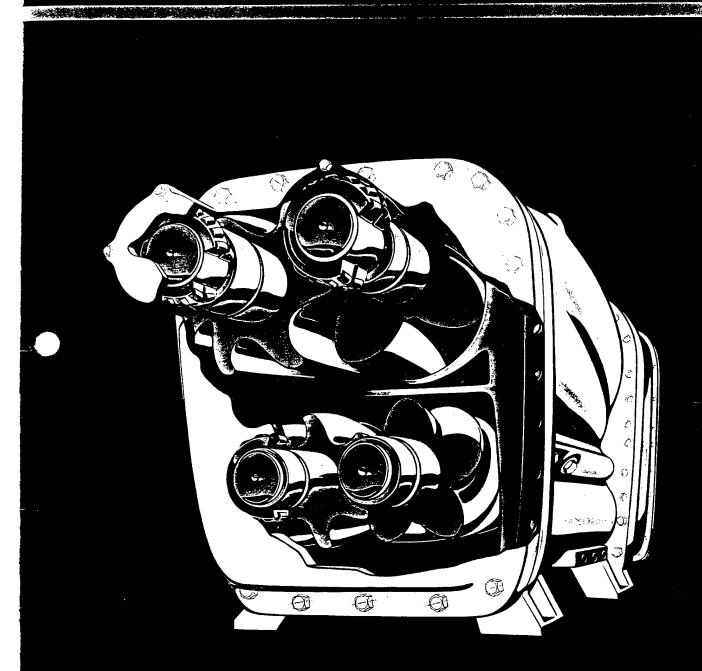
Annual O&M expenses are assumed equal to 1.5% of the construction costs per year:

Option with Desiccant Air Dryers:

\$3,156 per year.

Option with existing Refrigerated Air Dryers: \$3,217 per year.

Rotary Screw Air Compressors SSR 2-Stage



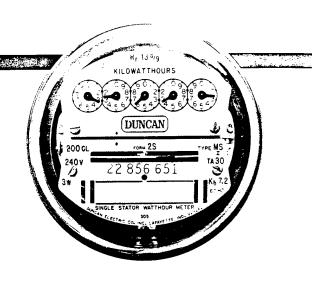
INGERSOLL-RAND® AIR COMPRESSORS:

Throughout the world, industry has come to depend on Ingersoll-Rand SSR rotary screw compressors for reliability, lower installation and operating costs, and superior designs.

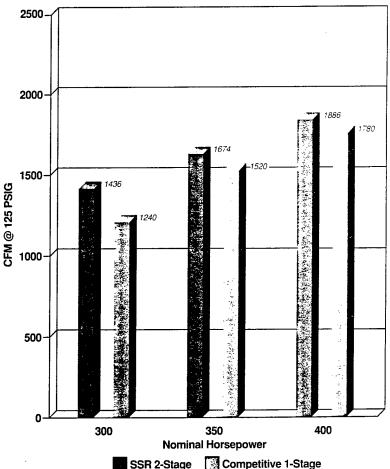
Now, Ingersoll-Rand has really stacked things in your favor with the SSR 2-Stage series of rotary screw air compressors. The advanced, stacked, two stage airend technology saves up to 15% in kilowatt costs, and when combined with our unique Intellisys stepper motor capacity control, gives you an exceptional combination of superior compressor technology and

The pairs of rotors in SSR 2-stage compressors fit into a combined airend assembly. Compression is shared between the first and second stages flowing in series. This increases overall compression efficiency up to 15% of the total full load kilowatt consumption. You can enjoy these savings for only a modest increase in capital cost over that of single stage rotary screw compressors.

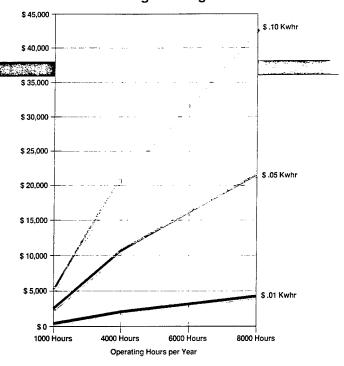
low operating costs.



SSR 2-Stage Efficiency



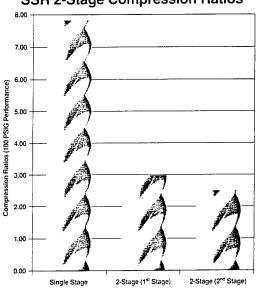
2-Stage Savings



Energy savings go a long way to reduce your compressor's initial cost and operating expenses. As a rule of thumb, our SSR 2-Stage compressor will save you up to \$534 per 1,000 hours of operation, basis a kilowatt cost of \$.01 per kilowatt hour (when compared to single stage compressors). If your power cost is \$.05 per kilowatt, and you operate 6,000 hours per year, your first year savings could be as great as \$16,000! Savings like these quickly recover the capital cost increment of the SSR 2-Stage over single stage rotary compressors, and it won't take long for the savings to return the entire cost of the compressor. Now that's significant!

Consider what factors contribute to compressor operating expense: energy; water (if water cooled); replacement parts, coolants and

SSR 2-Stage Compression Ratios



lubricants, and labor costs. SSR 2-Stage compressors don't require water or consume a great deal of costly renewal parts. Compare the SSR 2-Stage's energy and installation costs, and maintenance expense to other compressors. You'll see that the SSR 2-Stage compressors offer the lowest total cost and can provide a rapid return on investment.

Many electric utilities have programs to reward companies who demonstrate energy conservation. Your electric utility may be supportive of demand side energy management efforts. Typically the utility will reward effective conservation efforts with incentives. You should contact your utility to see what programs exist. More than likely SSR 2-Stage compressors will qualify as new or replacement compressor energy conservation projects.



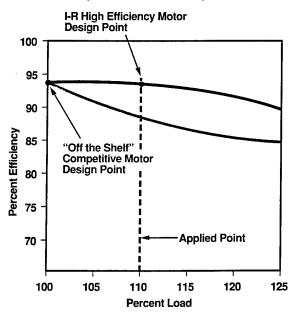


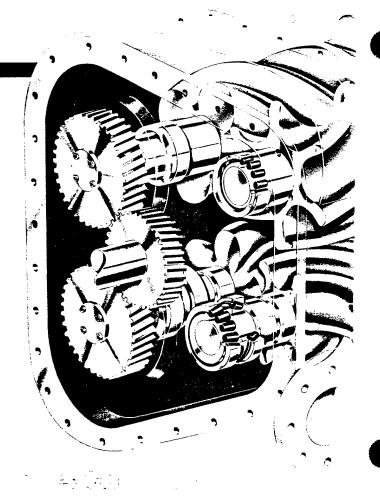
We challenged our engineers to design and deliver two stage efficiency with long term reliability and the typically low maintenance costs of Ingersoll-Rand single stage rotary compressors. The results exceeded our requirements, and the new two stage airend fits easily in our SSR market proven single stage, compressor package.

To achieve peak efficiency and because the two compression stages have different objectives our two stage, rotary screw airend uses different Ingersoll-Rand profile rotor sets. Our first stage rotors utilize a profile for high displacement and discharge at relatively low pressure. The second stage profile achieves high efficiency compression to final package pressure.

In addition to superior efficiency, we required reliability and long life as well. Both rotor sets use only the highest quality duplex tapered roller bearings. Duplex tapered roller bearing provide line contact to distribute the load equally over a larger area and dramatically extend the life of the airend. Our unique coolant dam traps coolant upon compressor shutdown, to assure proper bearing lubrication at startup and extended bearing life. No other manufacturer has a drive train equal to ours, and nobody but Ingersoll-Rand offers a standard two year, unlimited hour warranty on drive train components. Our drive train includes a standard high efficiency motor, optimizing gears, and our two stage airend. Each component complements the other, giving you the most reliable, rugged, and simplest form of power transmission ever built, and a warranty that proves it.

SSR motors are designed both mechanically and electrically to be the perfect match for each compressor. We use only copper windings and class F insulation for greater reliability and increased motor life. Our motor is a dedicated compressor motor, designed for a 115° F (46°C) ambient, and the efficiency is rated at the full load, "point of use" horsepower.





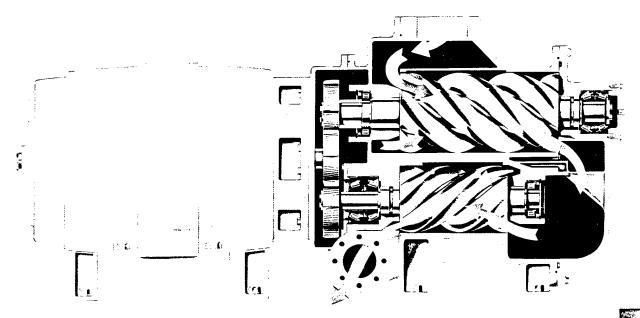
Integral gear drive is the most unique feature of our drive train. The drive gear (center) is mounted directly on the motor shaft, and the driven gears are mounted on the shafts of each male rotor. This eliminates maintenance prone and mis-aligned coupling or power robbing belts. The loads generated by the driven gears help offset the load on the drive gear further enhancing reliability and life. The drive is totally enclosed so that no dust or dirt can get in. Our exclusive seal and scavenge system prevents coolant from leaking into the motor.

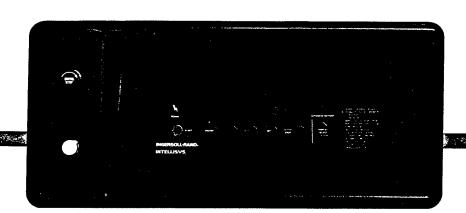


Air enters into the inlet of the first stage and is compressed as the male and female high displacement rotors rotate and mesh with each other. The first stage rotors discharge air through the coolant curtain located at the entry of the interstage area. Cooled air from the interstage enters the inlet of the second stage and is compressed by the high efficiency second stage male and female rotors. The compressed air now at desired system pressure passes through the second stage discharge port, and exits the two stage airend through the discharge flange.

To further enhance airend efficiency, coolant is injected into a channel at the first stage discharge port. A precisely machined liquid orifice in the channel creates a curtain of coolant in the interstage passage.

Air passes through the curtain on its way to the second stage, and through contact cooling, lowers the second stage inlet temperature. This patented process eliminates expensive noncontact cooling devices such as air or water-to-coolant heat exchangers.





The Ingersoll-Rand Intellisys® microprocessor controller makes operation of the SSR 2-Stage simple! All adjustments and display information are accessed through a finger-touch membrane panel, eliminating the need for tools and highly trained operating personnel.

The Intellisys monitors all compressor functions and displays information in plain language (not code) on a LED display.

- Off-line pressure
- · On-line pressure
- · Control mode selection
 - Intellisys Control, ACS
 - Modulation only
 - On-line/off-line
- Load/Unload delay time
- Star delta transition time
- Available as options
 - Remote start & stop
 - Auto start & stop
 - Auto start & stop shutdown time
 - Sequencer control
 - Power outage restart
 - Power outage restart time

The Intellisys constantly monitors 12 prime compressor operating parameters. In the event

any parameter deviates from its preprogrammed limit, Intellisys automatically warns and/or stops the compressor. The problem can then be displayed, saving costly troubleshooting expenses and minimizing downtime.

District Serve

- · Package discharge pressure
- Airend discharge temperature
- Injection coolant temperature
- Sump pressure
- Inlet filter condition
- Coolant filter condition
- Separator element condition
- Total hours/loaded hours

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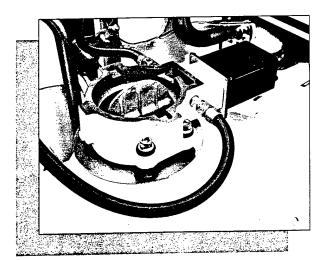
- Change inlet filter
- Change coolant filter
- Change separator element
- High airend discharge temperature

Part Shorth

- High airend discharge temperature
- High sump pressure
- Low unloaded sump pressure
- Low loaded sump pressure
- · Starter fault
- Low inlet vacuum
- Main motor overload
- Fan motor overload
- Reverse rotation
- · Pressure transducer failure
- Temperature sensor failure



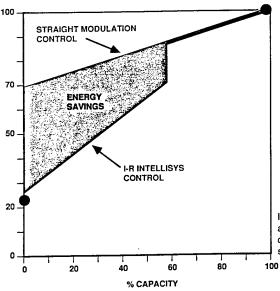
The Intellisys microprocessor controls Ingersoll-Rand's innovative stepper motor inlet-control for precise inlet throttling to match system requirements. This advanced control system automatically throttles the compressor to match pressure to load through our exclusive stepper motor. That means no more manual recalibrating to correct pressure drift every few months—it's now done simply and accurately through the Intellisys control panel.



For the first time, you have an automated air compressor-based system for efficient, real time energy management. The Intellisys ACS

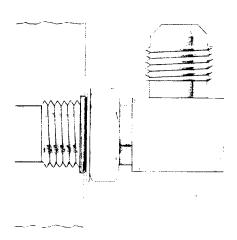
(Auto Control Selector) control operates the compressor in on-line, off-line during low demand periods (0-60% capacity), or in upper range modulation during medium to high demand periods (60-100% capacity).



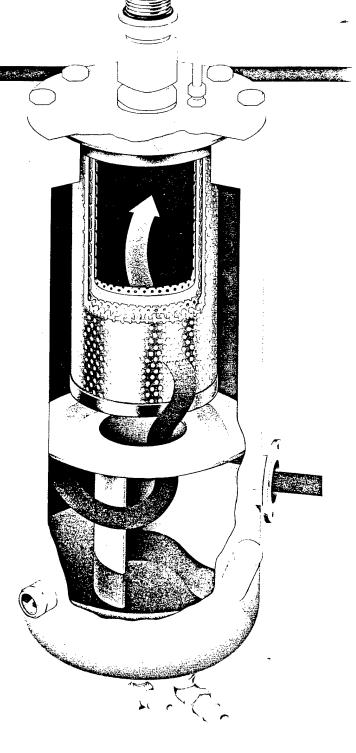


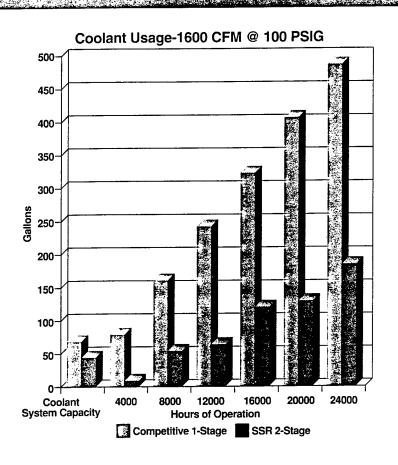
Realizing pressure is a function of volume, the Intellisys controller continuously monitors pressure and its rate of decay or increase. Intellisys automatically selects the operating mode which best fulfills the system's need for compressed air, all the while operating the compressor in its most efficient mode.

Intellisys Control saves up to an additional 16% in energy cost when compared to straight modulation control The SSR air-coolant two-stage separator system has a truly unique and innovative design. A baffle, located in the separation sump tank, performs first stage mechanical separation. The second stage separator element resides above another baffle which creates a dry sump. This two stage separation system limits carryover to less than 2 ppm downstream of the package discharge.



Ingersoll-Rand has cut the number of fittings, pipes and hoses in the SSR by 40% to reduce potential leakage problems. To further reduce potential leak problems associated with conventional threaded connections, Ingersoll-Rand's SSR compressors use SAE "O" Ring fittings on connections larger than 1/4" in diameter. These fittings are designed to provide improved installations and connections. SAE "O" rings are the preferred fittings for most hydraulic applications.





All SSR's are factory-filled with our exclusive Ultra Coolant, a polyglycol synthetic compressor coolant. Ultra Coolant is so advanced that it only requires changing every 8,000 hours or two years under normal operating conditions. Using the lubrication system's inherent sump pressure, a positive flow of Ultra Coolant simultaneously lubricates, cools, and seals the rotor chambers during all operating conditions. Ultra Coolant offers superior separation for lower coolant make-up, and will not form varnish or sludge under any circumstances.

Ingersoll-Rand is concerned about the environment and designed this compressor accordingly. The combination of SSR Ultra Coolant and our unique separator design respect the environment by significantly reducing coolant usage.

Separated coolant circulates throughout the system so efficiently, the SSR 2-Stage compressor's coolant capacity is up to 35% less than other compressors. Coupled with our 8,000 hour coolant life and less coolant to begin with, you can dramatically reduce coolant and disposal costs.

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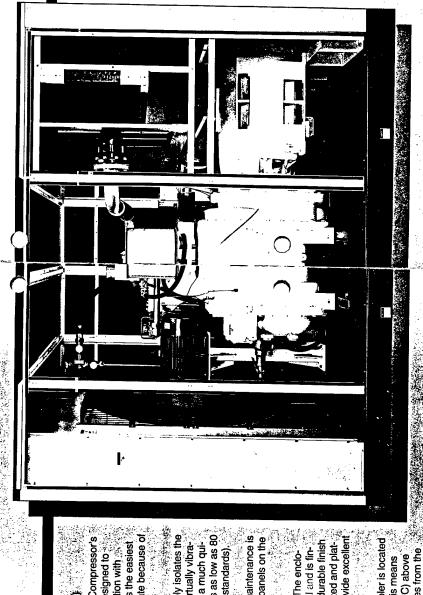
The Ingersoll-Rand SSR Rotary Compressor's totally integrated package was designed to combine smoother, quieter operation with segreater servicing convenience. It's the easiest rotary screw compressor to operate because of these key features:

Quieter Operation A subassembly isolates the drive train from the package for virtually vibration free operation. This results in a much quieter compressor with sound levels as low as 80 dbA (according to CAGI/Pneurop standards).

Superb Serviceability Routine maintenance is done through convenient latched panels on the package.

Superior Package Appearance The enclosure is fabricated from sheet metal and is finished with a superior high quality durable finish of baked on textured paint. Anodized and plated or coated pipes and fittings provide excellent corrosion resistance.

at the inlet end of the package. This means cool compressed air, only 15°F (8°C) above ambient air temperature, discharges from the package.



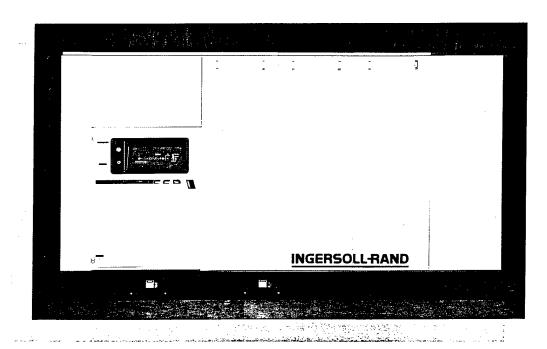
Single-point Connections The SSR is fully piped and wired, resulting in simple external connection of all utilities.

Spin On Coolant Filter The SSR incorporates a spin-on coolant filter for easier removal and replacement.

Higher Ambient Operating Temperatures
The SSR is designed to run efficiently in 115°F
(46°C) ambients. During hot summer months
disruptive high temperature shutdowns are
avoided.

Star Delta Starter Standard, and integrally mounted on all 250-350 horsepower 460V and 575V models. 400 and 450 horsepower, 460V and 575V models are supplied with remote starters.

Convenient Top Exhaust The cooling air flow discharges from the top of the package to facilitate easier ducting of waste heat for removal or recovery.



The SSR's Intellisys Controller has four optional software programs to customize your compressor operations:

Auto Start/Stop allows you to program the automatic starting, stopping, and restarting of the compressor.

Remote Start/Stop gives you offsite on/off control when the compressor is operating.

Modulation Percentage of Load enables you to monitor the percent of full load air flow the compressor is producing.

Power Outage Restart allows you to have your air compressor automatically restart after incoming power is restored if a power failure occurs.

- Water-cooled
- 2300V and 4160V Models
- 50 Hertz Models
- 380/3/60 Models
- TEFC Motor
- Premium Efficiency ODP & TEFC Motors
- Starter Elimination
- · Aftercooler Elimination
- Sequence Control
- NEMA 4
- · Outdoor Modification
- · Low Ambient Modification
- Phase Monitor
- High Dust Filter

SSR Specifications (60 Hertz)

Model	НР	FAD*	Maximum Modulation Pressure	Full Load Pressure	Length	Width	Height	Weight
SSR XFE250-2S	250	1355	110	100	148 in.	76 in.	85 in.	13,080 lbs.
SSR EPE250-2S	250	1213	135	125	148 in.	76 in.	85 in.	13,080 lbs.
SSR HPE250-2S	250	1154	150	140	148 in.	76 in.	85 in.	13.080 lbs.
SSR HXPE250-2S	250	868	210	200	148 in.	76 in.	85 in.	13,080 lbs.
SSR XFE300-2S	300	1602	110	100	148 in.	76 in.	85 in.	13080 lbs.
SSR EPE300-2S	300	1436	135	125	148 in.	76 in.	85 in.	13080 lbs.
SSR HPE300-2S	300	1362	150	140	148 in.	76 in.	85 in.	13080 lbs.
SSR HXPE300-2S	300	1047	210	200	148 in.	76 in.	85 in.	13080 lbs.
SSR XFE350-2S	350	1866	110	100	160 in.	82 in.	96 in.	14865 lbs.
SSR EPE350-2S	350	1674	135	125	160 in.	82 in.	96 in.	14865 lbs.
SSR HPE350-2S	350	1595	150	140	160 in.	82 in.	96 in.	14865 lbs.
SSR HXPE350-2S	350	1230	210	200	160 in.	82 <u>in.</u>	96 in.	14865 lbs.
SSR XFE400-2S	400	2096	110	100	160 in.	82 in.	96 in.	14865 lbs.
SSR EPE400-2S	400	1886	135	125	160 in.	82 in.	96 in.	14865 lbs.
SSR HPE400-2S	400	1798	150	140	160 in.	82 in.	96 in.	14865 lbs.
SSR HXPE400-2S	400	1405	210	200	160 in.	82 in.	96 in.	14865 lbs.
SSR XFE450-2S	450	2310	110	100	160 in.	82 in.	96 in.	14865 lbs.
SSR EPE450-2S	450	2093	135	125	160 in.	82 in.	96 in.	14865 lbs.
SSR HPE450-2S	450	2002	150	140	160 in.	82 in.	96 in.	14865 lbs.
SSR HXPE450-2S	450	1578	210	200	160 in.	82 in.	96 in.	14865 lbs.

^{*}FAD (Free Air Delivery) = Total Package CFM at the rated full load pressure, delivered at the customer connection, inclusive of all losses, and related back to inlet conditions.

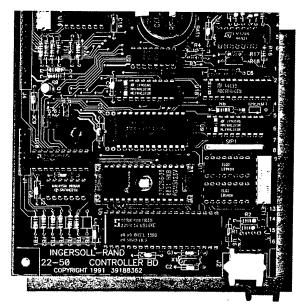
Note: Physical dimensions and weights vary with certain options. Consult your Sales Representative for specifics.

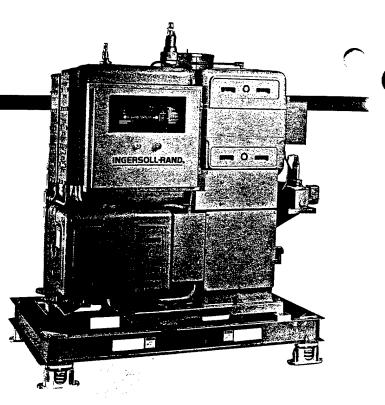
LLE Reciprocating Air Compressor



The first compressor ever designed was a Reciprocating Compressor. In the many years since its invention, the technology has greatly improved. Today, Reciprocating compressors provide the highest efficiency of any current compression technique. Additionally, this experience has perfected the mechanical aspects of the design to produce the longest life possible.

Since its introduction the LLE has grown in reputation as an innovative, reliable and exceptionally efficient air compressor. The LLE's design is based on the reciprocating compression principle, which is the most efficient and dependable method of air compression yet devised. Over 6,000 varied installations, in all types of environments,





testify to the LLE's ruggedness - a ruggedness that allows the LLE to prevail under harsh operating environments that frequently stop ordinary compressors.

Ingersoll-Rand pioneered the application of advanced microprocessor based controls for compressors, with the Intellisys® family of intelligent controls. The Intellisys® is the most ingenious and innovative control system on any air compressor. Installed on the LLE, it makes the compressor virtually self-sufficient.

Thousands of Ingersoll-Rand Intellisys® controlled compressors already at work around the world attest to the reliability and dependability of this unique microprocessor control. Also, since all Intellisys® share a common heritage and design philosophy, continuity is assured.





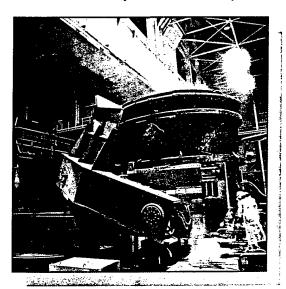
The best measure of compressor efficiency is the kilowatts required to compress the air. With the LLE, superior efficiency results from an inherently efficient design, superbly executed.

At full load output, the LLE is commonly as much as 15% more efficient than screw compressors. At reduced output levels, its efficiency advantage gets even better due to the microprocessor-based multi-step control system. Energy savings continue even when the compressor is running at "no load" because the no-load horsepower is typically less than half that of other types of compressors. This single benefit, the inherent ongoing energy savings, is justification enough for many customers to purchase the LLE compressor.

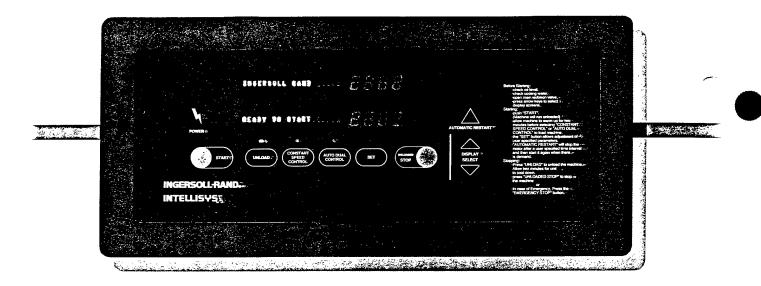
Unfortunately, not all compressor installation environments are as clean and well ventilated as the installation manual recommends. If there is no choice but to site a compressor in a less than ideal environment, then special attention to specify the right compressor is mandatory.

The extremely rugged LLE is frequently the compressor of choice in these instances. Its heavy duty, water-cooled construction and forgiving nature make it ideal for reliable operation in extraordinary applications.

Ordinary air compressors are designed for ordinary installation requirements. If you put an ordinary compressor in an extraordinary application, trouble is usually not far behind. Fortunately, the Ingersoll-Rand LLE is not an ordinary compressor, which makes it the ideal solution for your extraordinary needs.



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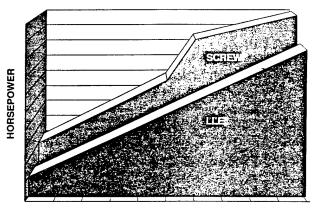
The Intellisys® is an Ingersoll-Rand designed and built electronic, microprocessor based controller. Every quarter of a second, it monitors, within 1% accuracy, all system parameters as well as the compressor's condition. This virtual real-time accurate monitoring allows the compressor to be operated with total assurance.

The Intellisys® comes factory tested and preset for normal operation. All monitored pressures and temperatures have adjustable alarm points and most monitored functions have both a warning and shutdown mode. However, if site adjustments to the compressor control system are desired to make it a perfect fit, the Intellisys® can be adjusted from the membrane panel. Since mechanical control adjustments on the compressor have been eliminated, special tools and highly trained operating personnel are no longer required. In addition, the adjusted value is exactly what is displayed on the Intellisys® within 1%.

The LLE will warn you when a programmed limit is being approached and it will shutdown if the limit is exceeded. The Intellisys® utilizes first-out annunciation to detail the sequence of events.

The LLE is the most efficient plant air compressor available. When the air demand drops, the control systems come into play delivering an even more impressive efficiency. The Intellisys® equipped LLE offers Constant Speed Control and Auto-Dual Control as standard. Constant Speed Control will operate the compressor fully loaded, partially loaded and unloaded depending on system demand.

Auto-Dual Control is Constant Speed Control with the added feature of automatically stopping the compressor if it runs unloaded for a user specified time interval. This control system provides the highest attainable partial load efficiency, giving you significant cost savings.



AIR CAPACITY DELIVERED

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When evaluating which air compressor to purchase, remember that what you are really buying is compressed air. Therefore, it is important to consider all the costs involved in producing compressed air.

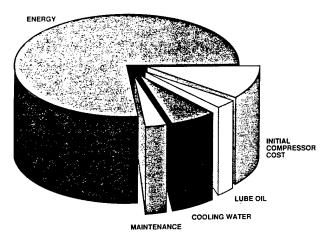
These costs include:

- Initial Compressor Cost
- Compressor Installation Cost
- Cooling Water Cost (if required)
- Compressor Maintenance Costs
- Energy Costs

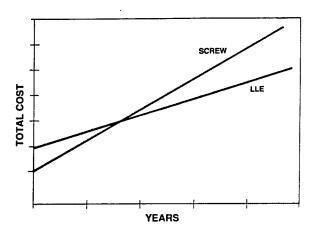
Putting these costs in perspective, the yearly energy costs will far outweigh all other compressed air costs.

Over the total life of an LLE all costs other than energy are insignificant, including the compressor purchase price.

LLE 5 YEAR TOTAL OPERATING COST



Consider the total life cycle cost of supplying 800 cubic feet per minute of air at 110 psig for five years. Comparing an LLE and a lubricated rotary screw, the LLE will cost more initially but its superior operating efficiency greatly reduces energy consumption. In fact, the initial cost is typically made up in less than two years of operation. Over five years of operation the LLE will be significantly more economical.



In order to help intelligently evaluate the various air compressor choices, Ingersoll-Rand has developed a computerized evaluation program which takes all the relevant factors into consideration. Contact your local Ingersoll-Rand representative for a no cost, no obligation evaluation of compressor choices specific to your situation.

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Technically, an LLE can be described as a crosshead-type, double-acting, water-cooled, packaged, reciprocating compressor. While accurate, this description does not adequately convey the remarkable durability inherent in every LLE. This is a machine intended to be run hard for long periods without interruption.

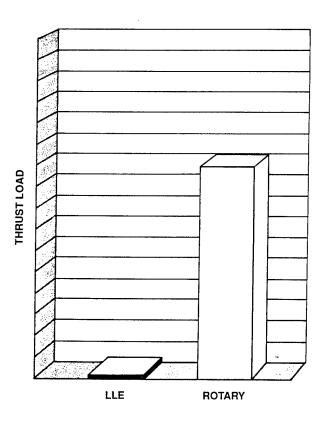
The basic design philosophy of the LLE is responsible for this longevity. For example, the compressor runs at a fraction of the rotative speed commonly seen today with other compressor designs.

Further, the lubrication system automatically and continuously provides metered amounts of fresh lubricant to the compression chambers. This lubrication technique continuously "flushes" the cylinders, assuring reliable performance. No recirculation of compression lubricant is permitted, by design, in the LLE.

One of the principle causes of compressor breakdown on rotary compressor designs is failure of the thrust bearings. This is due to the high axial thrust component inherent in the design of these machines.

The LLE essentially eliminates thrust load within the machine, resulting in much longer life for the bearing system. The main bearings in an LLE have a design life in excess of 30 years and experience to date validates this expectation.

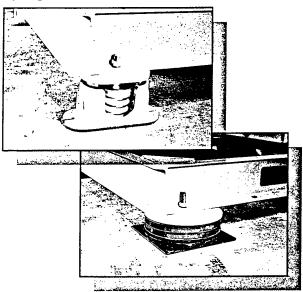
When durability and reliability are required the LLE is the compressor of choice.



The LLE comes completely factory assembled, tested and ready to run. Everything is built-in, not added on, including the intercooler, aftercooler (if purchased), flange-mounted motor, Intellysis controller, inlet filter and starter (if purchased). Due to the LLE's low inertial loads, it can be mounted on vibration isolators to further simplify installation. With a 6 to 8 inch reinforced concrete floor a foundation is normally not needed. The LLE package is so efficiently designed that it takes up as much as 50% less floor space than a rotary screw. The following are all the site connections that are required:

- · Power to starter
- Air discharge
- Condensate
- · Water in and out

Spring Mount



Rubber Mount

Compressor servicing has not been overlooked in the LLE design, either. Many features have been integrated to make necessary service quick and easy.

The LLE is like no other reciprocating compressor ever designed. These unique features minimizes routine maintenance and simplify what little effort is required.

- Routine maintenance consists of oil, filters and minor inspections.
- 3 5 year valve life is not uncommon when synthetic lubricants are used.
- Removable tube bundles with 5/8 inch straight tubes makes cooler cleaning easy.
- Lubricator oil reservoir (optional) and Ren valve allows days between refills.
- All maintenance can be accomplished by your staff.
- Single-bolt valve covers greatly simplify valve inspection and/or maintenance.
- Water-cooled cylinders and synthetic lubricants greatly extend ring life.
- Intellisys® extensive monitoring allows for easy trending, making maintenance predictable.
- Water-cooled packing casings extend packing life.
- Built-in pulsation chambers greatly increase valve life.
- No mechanical adjustments, all components precision machined to exact tolerances, simply fit pieces together.

high efficiency. Air flow between cylinders and cooler sections is completely internal, minimizing pressure drops and eliminating piping strain on cylinders. The coolers include solenoid the-tubes, removable bundle heat exchangers which provide The Intercooler and optional aftercooler are compact, water-invalve condensate traps for trouble free operation

Controller - the most advanced and easy-to-use Microcontroller in the industry today. Control for the LLE is provided by the integral Intellisys®

Remove a valve in seconds for easy inspection and maintenance with the LLE's unique single-bolt design. There are only remove a valve by loosening just one more bolt. four valve covers to a cylinder, and once inside you can

ngersoll-Rand's unique channel valve design is one of the key valves float rather than slam against their stops. The channel design also provides the quickest and easiest maintenance of reasons for the LLE's longevity. These special air-cushioned any inlet/discharge valve.

prevent air leakage and the loss of crankcase oil along the rods. The packing/wiper rings have integral wear stops to prevent scoring of piston rods and are assembled in a single Self-adjusting, metallic-packing and oil wiper rings cartridge for easy maintenance.

Cylindrical, full-bored crosshead guides are designed for the life of the compressor with permanent alignment requiring no shims or

The crosshead is a one-piece, shoeless design utilizing hydro-dynamic principles to eliminate any metal to metal contact which results in low parasitic losses and virtually infinite life.

through internal passages. The large oil reservoir enables the LLE to run surized, filtered oil to all bearings for months. A shaft-driven pump delivers pres-

This specially designed sound suppressing, weatherproof filter comes factory mounted with a replaceable dry-type element. An efficiency gauge signals the need for filter element service.

designed to minimize air pulsations which greatly increases The large air passages in each cylinder head are computer valve life. The heads and cylinder barrels are water-jacketed to insure the lowest possible operating temperature. This greatly reduces wear and enhances life.

High-strength, low-mass wafer pistons result in low inertial loads and unbalanced forces, so little or no foundation is

The LLE comes standard with a flange mounted motor directly connected to the crankshaft. As an option, direct connected and v-belt drives are available.

rate motor driven, compressor mounted, lubricator. An optional Force-feed lubrication to the cylinders is provided by a sepaoil reservoir with fill valve can be supplied to extend fill-up intervals A rugged, large diameter, forged steel, rigid crankshaft insures maximum stability and long life. Specifically designed integral counter weights provide for smooth operation and require no maintenance.

Ë

frame protects all moving parts, including piston rods, from dust, The LLE's sealed and gasketed

and water. The compact design

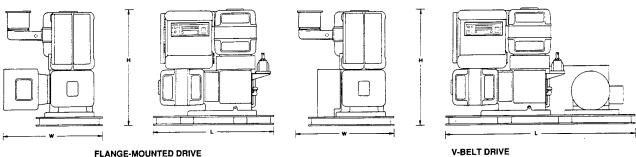
adjustments.

saves space.

duty, self-aligning, spherical roller bearings with a design life of over 30 years of continuous duty operation. The crankshaft is mounted in heavy



1-34



FLANGE-MOUNTED	DRIVE
----------------	-------

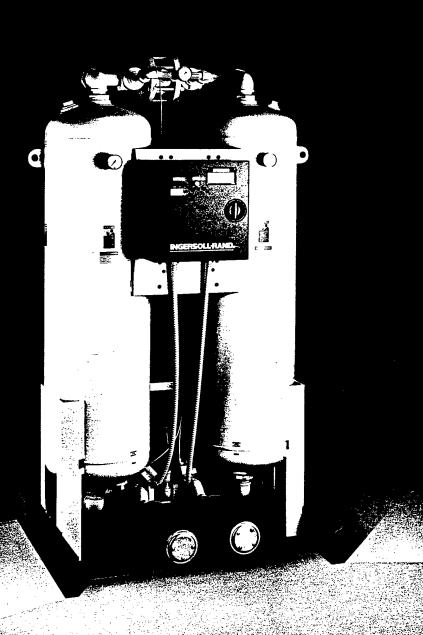
Model	Motor HP	Capacity ACFM 100 Psig		nensions w e-Mounted W		Din \ L	Approximate Weight Pounds		
LL2	75	400	6'0"	5'0"	6'2"	8'7"	5'2"	6'2"	7800
	100	505			_	8'7"	5'2"	6'2"	7900
	125	570	6'0"	5'0"	6'2"	8'7"	5'2"	6'2"	8000
LL3	100	535	6'0"	5'0"	6'2"	8'7"	5'2"	6'2"	7900
	125	635	_	_	_	8'7"	5'2"	6'2"	8000
	150	715	6'0"	5'0"	6'2"	8'7"	5'2"	6'2"	8100
LL5	125	634	6'4"	5'2"	6'4"	8'11"	5'4"	6'4"	9500
	150	810	6'4"	5'2"	6'4"	8'11"	5'4"	6'4"	9600
	200	955			_	8'11"	5'4"	6'4"	9700

Ingersoll-Rand Company is in its second century of service to the world's industries. Starting with Simon Ingersoll's first invention in 1871, Ingersoll-Rand has been developing innovative solutions to serve the ever-changing needs of industries. In the years since, we've grown into a multi-billion dollar company with manufacturing and sales operations throughout the world. In addition to all types of air compressors, we manufacture a wide variety of industrial machinery and equipment for many markets that have one thing in common - Ingersoll-Rand's commitment to innovation and quality.

Ingersoll-Rand and our Distributors all around the world stand ready to provide a variety of creative solutions to your needs for compressed air. There are Ingersoll-Rand manufacturing facilities, offices or distributors in over 130 countries around the globe, each with experienced and knowledgeable people. You can depend on getting practical application assistance and prompt maintenance repair or spare parts no matter when or where they are needed.

No company in the world has more experience in the design and manufacture of air compressors than Ingersoll-Rand. With an LLE you are investing in not just a machine, but a world-wide reputation for quality and reliability. This is peace of mind that comes from dealing with the world's most experienced compressor manufacturer.

Heatless Regenerative Dryer HRD Series

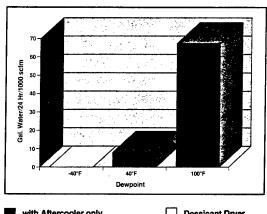


INGERSON RAND. Alr COMPRESSORS

In today's demanding process, instrumentation and high tech manufacturing environments, clean and dry compressed air is mandatory for optimum results. Water and water vapor, lubricants, rust and dirt must be completely removed from the compressed air. Failure to remove them frequently results in product spoilage, downtime and increased costs of operation.

To remove water or water vapor, some type of dryer is required, to reduce the "dewpoint" of the compressed air. The two most common types used today are the Refrigerated and Desiccant dryers. Refrigerated Air Dryers can reduce the dewpoint of compressed air to only 33°-39°F (1 °-4°C), as condensed water turns to ice at lower temperatures, causing ice blockages and air flow stoppage. For dewpoints down to -40°F (-40°C) or lower, a Desiccant dryer is clearly the preferred solution, because its' "adsorption" principle works on water vapor only.

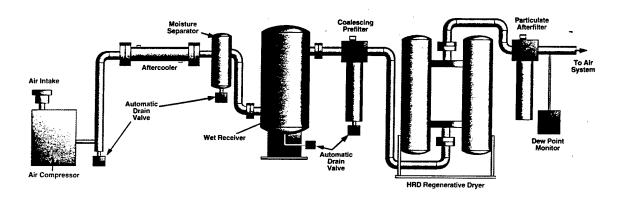
Moisture Content of Compressed Air



with Aftercooler only Refrigerated Air Dryer Dessicant Dryer

THE OF DESTREET OF THE

Desiccant Dryers are available in two basic variations, Heatless and Heated. Both types utilize dual pressure vessels, along with appropriate valving and automatic controls. to switch between the active and the regenerating vessel. One vessel is actively drying the compressed air while the other vessel is being regenerated. The two vessels switch back and forth, with the regenerated vessel becoming the active vessel, as the other vessel regenerates.





While both types of Desiccant Dryers each have advantages and limitations, the Heatless type is the most popular, due to its' inherent advantages of high reliability and low maintenance.

The desiccants used in HRD dryers have been selected basis our twenty five plus years of experience in the design and manufacturing of Desiccant Dryers. The vessels have been designed specifically for this service. Vessel diameters have been chosen to allow a minimum of five (5) seconds contact time, which is essential for complete moisture adsorption and consistent dewpoints. Air velocity through the dryer has been conservatively designed at less than sixty-five feet per minute, minimizing desiccant fluidization and dusting, and resulting in high dryer reliability.

Ingersoll-Rand's HRD heatless desiccant dryers are designed to produce a consistent -40°F (-40°C) dewpoint compressed air.

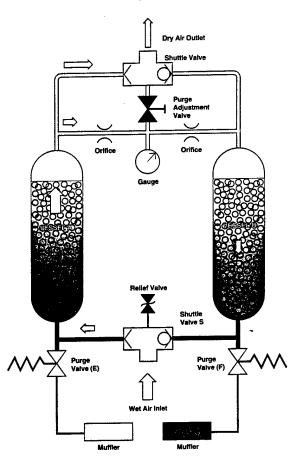
Optional HRD dryers for -100°F (-73°C) are also available.

Saturated compressed air enters the dryer at the inlet valve and into the bottom of the active vessel. Moisture is absorbed by the desiccant as the air flows upward through the vessel. Dry compressed air exits at the outlet valve, dried to the design dewpoint rating.

A portion of the dry air is diverted, and metered through the purge adjusting valve,

through the vessel being regenerated, drying the wetted desiccant and preparing it for reuse. This purge air is exhausted through the purge exhaust valve and the silencer, having served its' purpose.

In the fixed cycle mode, each vessel operates for approximately four minutes before switching. This vessel switching procedure is repeated again and again, assuring a continuous flow of dry air from the unit.





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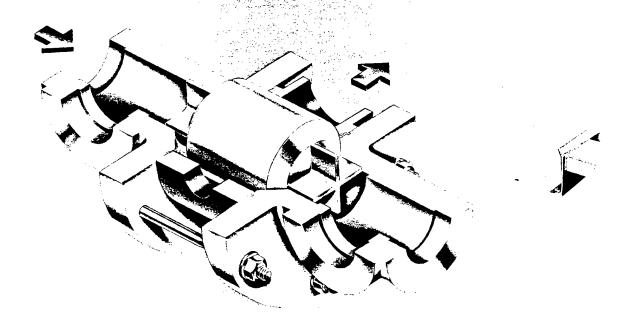
The Ingersoll-Rand HRD series desiccant dryer line has a very comprehensive array of standard features to give you high reliability, easy operation and minimal maintenance. Standard features include:

for superior performance and long operating life. Since the switching valves of a Desiccant Dryer are really the heart of any Desiccant Dryer, we have developed an exclusive valve design, offering the following advantages

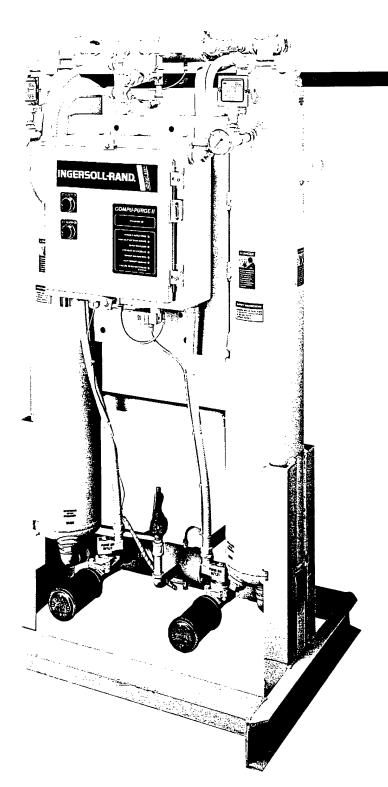
- Only one moving part in our Shuttle valves, eliminating the maintenance on actuators,

control air regulators, filters and solenoids frequently seen on competitive designs.

- Extremely long and trouble-free service life. Our shuttle valves have been tested for more than 500,000 cycles without a problem, the equivalent of 10 years continuous operation. We are so confident of this design, we offer a Lifetime Warranty On Valve Components.
- Corrosion-resistant materials are used on all valve components, both internal and external.
- Continued compressed air flow, even with loss of electrical power to the dryer.







Reduced maintenance costs resulting from our use of only three (3) valves to control air flow switching, compared to as many as thirteen (13) separate valves used on some competitive designs.

Upflow drying, which protects the desiccant bed by minimizing the effects of water accidentally hitting the desiccant beads.

ASME designed and constructed pressure vessels to assure safety and high quality construction.

Pressure relief valve to comply with local codes.

Desiccant fill and drain ports eliminate the need to dismantle dryer piping, reducing maintenance time and cost.

Vessel pressure gauges identify drying and regeneration vessels at a glance.

Adjustable air purge control permits a purge rate of 13% to 17% (at 100 psig) to be selected for varying seasonal and process requirements.

Purge air flow indicator allows easy adjustment of purge flow rate.

Purge Air mufflers designed to meet OSHA standards for noise.

Fully automatic control system utilizes a time proven electric cam timer to control dryer functions reliably.



The Ingersoll-Rand HRD series offers an outstanding range of factory installed options to customize the dryer to your needs and desires.

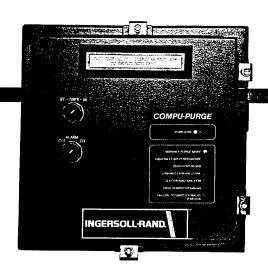
COMPU-PURGE® Control is our state of-theart microprocessor based purge air control system, specifically designed to maximize energy savings by matching purge air usage to actual moisture loads on the dessicant bed.

COMPU-PURGE features:

- Active moisture load calculation
- Automatic programming of purge flow and purge time to match actual moisture load
- Self adjusting no operator maintenance
- Simple no wearing parts
- Constant dewpoint @ -40°F (-100°F optional)
- Substantial energy savings over constant purge cycle control

All Desiccant Dryers are specified and sized basis an assumed set of conditions including air flow, inlet temperature, inlet pressure and expected dewpoint, which then allows calculation of the total moisture load to be removed. Since most dryers are not constantly run at these conditions, most of the time fixed cycle controls tend to over-dry the desiccant, wasting energy. **COMPU-PURGE** is Ingersoll-Rand's answer to this situation, allowing the purge rate, and hence the energy consumption, to be minimized, matching the actual conditions being experienced and the actual moisture load to be removed.

COMPU-PURGE should be specified whenever the dryer is anticipated to operate less than 24 hours per day or when it is intended



to operate at reduced or fluctuating loads throughout the day. Energy savings will quickly recover the incremental price adder for COMPU-PURGE. The COMPU-PURGE Savings Chart effectively illustrates these savings.

Compu-Purge Savings

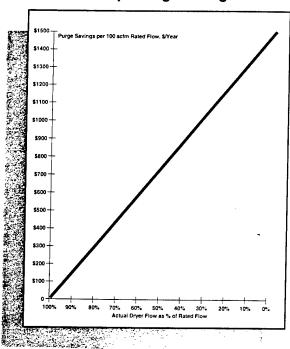
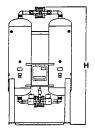


Chart assumes dryer operation at standard rating conditions of 100°F, 100 psig, 100% R.H. Inlet air and -40°F pdp at 15% purge. Assume dryer usage at 365 days/year and air cost at \$0.18/1000 scf.



Additional HRD series dryer options include:

- Switching Failure Light with alarm contact
- High Humidity Light with alarm contact
- Moisture Indicator
- -100°F Pressure Dewpoint
- NEMA 4, 12 Electrical Enclosure
- NEMA 7 (Class 1, Division II, Group D)
- Special Corrosion Resistant Paint
- 250 Psig Operating Pressure
- Pneumatic Controls
- Dewpoint Monitor
- 50 Cycle Operation
- Special Packaging of Filter and Dryer
- Other specially engineered options

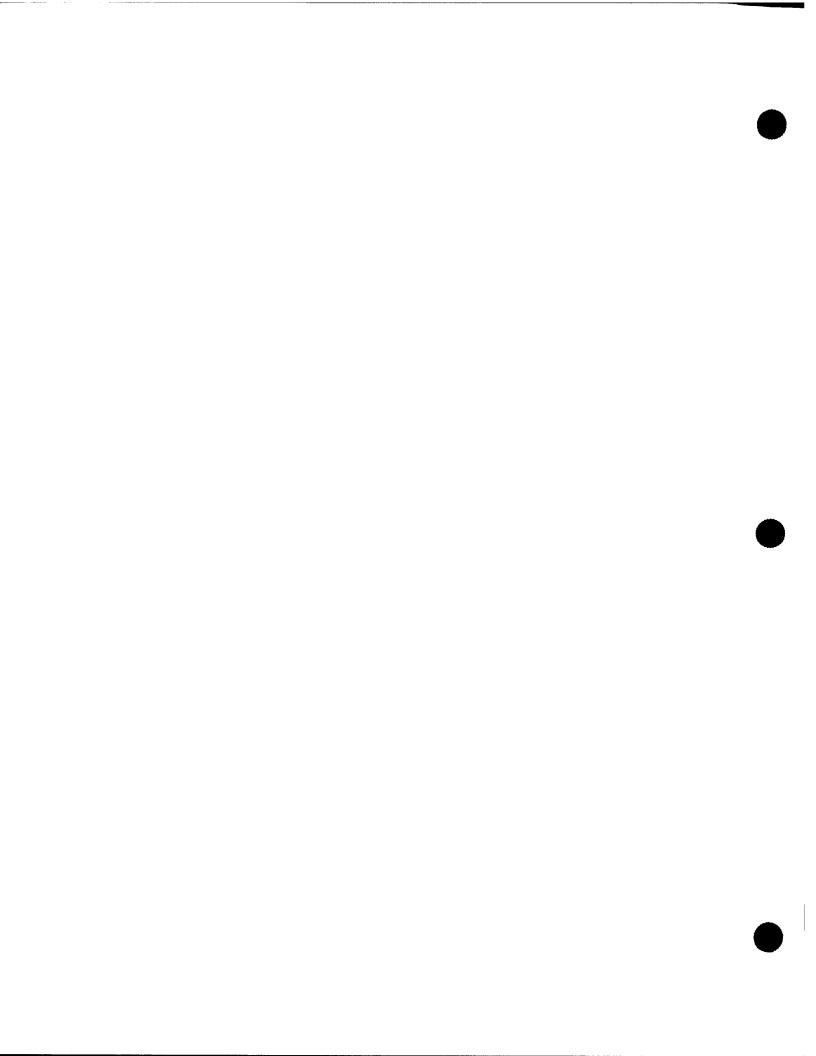




Model	Capacity (1) (scfm)		Dimensions Inlet/Outlet (inches) (inches NPT)		(inches) (i		Approx. Shipping Weight
	,	Н	D	W		(lbs.)(2)	
HRD5 HRD10 HRD15 HRD20	100 160 200 275	67 69 85 85	28 28 40 40	36 38 38 39	1 1 1½ 1½	800 850 870 1020	
HRD25 HRD30 HRD35 HRD40	350 475 600 800	83 84 85 114	40 40 40 50	44 46 47 67	2 2 2 2 3	1140 1680 2000 2620	
HRD45 HRD50 HRD55 HRD60	1000 1200 1440 1700	115 116 117 118	50 50 50 50	68 70 72 73	3 3 3 3	3000 3500 - 4320 4950	
HRD65 HRD70 HRD75 HRD80	2000 2265 2575 3240			Con	 sult Factory		
	3240	are availab	le. Contact	Factory for	ratings and specification	S.	

⁽¹⁾ Capacity is at standard rating conditions per NFPA/T3.27.3M R1-1981 (ANSI B93.45)-i.e., 100°F inlet air temperature, 100 psig inlet air pressure, 100°F inlet pressure dew point, and 100°F ambient temperature. Maximum pressure drop across dryer is 5 psi. Pressure dew point at standard rating conditions is -40°F. (2) Desiccant shipped loose on Models HRD 40 and larger. Shipping weight for these models is less desiccant.





EEAP Energy Survey of Army Industrial Facilities Western Area Demilitarization Facility, HWAAP, Nevada **APPENDIX J** High Pressure Water Pump System Retrofit Calculations F\PROJ\1640316\WORD\ARMY_IND.SRV 941209

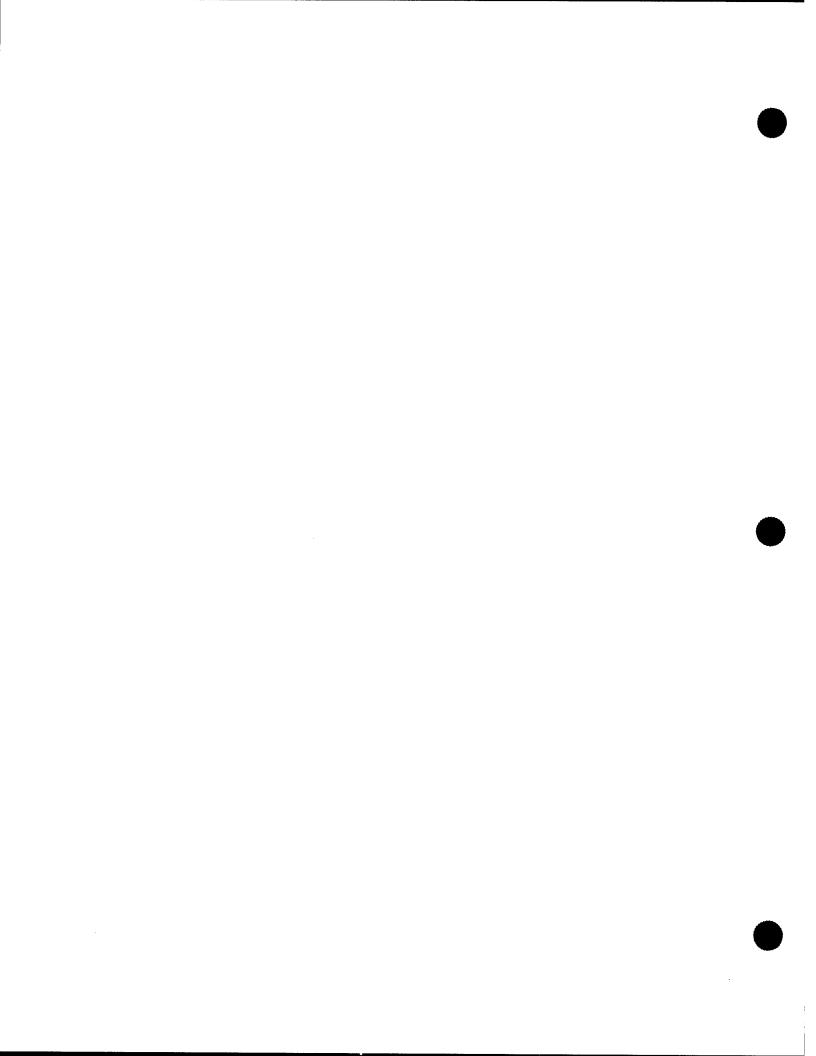
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EEAP Energy Survey of Army Industrial Facilities Western Area Demilitarization Facility, HWAAP, Nevada

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High Pressure Water Pump System Retrofit Calculations

The high pressure water pump system is housed in Building 117-6A, next to the steamout building. Five (5) high pressure water pumps serve operations in the steamout building. The pumps provide about 13,000 psig water to hydraulic cleaning equipment in building 117-6. Four of the five pumps are normally operated, with one as a spare.

The pumps are positive displacement pumps and are energized whenever the shakeout tables in building 117-6 are operated, about 10 hours per day, 6 days per week.

In order to maintain continuous high pressure water service to the washout lances, the pump discharges are recirculated to pump suctions. This requires all energized pumps to operate at peak load continuously.

Install Variable Frequency Drives to Control High Pressure Water Pump Speeds

A modification to high pressure water pump operation is proposed. Provide variable speed pump control, responding to demand at the washout lances. Variable speed control of the high pressure water pumps will reduce energy consumption, causing the pumps to operate at full load only when required, and will modulate pump speed under lower loads to only that speed needed to maintain water pressure.

High pressure water pump and pump motor nameplate data is as follows:

Pumps, 4 Each:

Partec Equipment No. HC17F High Pressure Water Pump

Motor: 150 HP, 20 gpm, DO Pressure: 10,000 psig

Lube Type: O/M

Note: pump heads have been modified to provide 13,000 psig.

Pump Motors, 1 Each Pump: Toshiba, Model No.: B1504FL F4U3

Frame: 445T, Code 3, NEMA Class F, Design B

150 HP, Class F, Service Factor 1.15 460 VAC, 60 Hz, 1770 RPM, 178 FLA

Pumps heads have been modified from the original design pressure of 10,000 psig to operate at 13,000 psig. Operating load and power consumption measurements made during September 1994 are as follows:

		A	mperag	ge	Voltage	Power Factor			Calculated	% Full	
Pump No	o. Shaft RPM	Α	В	С	Measured	Α	В	С	kW	Load	
1	1,777.6	156	162	164	464	0.83	0.83	0.82	106.7	74.7%	
2	1,777.6	154	158	160	464	0.80	0.82	0.85	104.1	74.7%	
3	Pump Off	NA	NA	NA	NA	NA	NA	NA	0	NA	
4	1,775.8	166	163	169	464	0.82	0.82	0.82	109.4	80.7%	
5	1.774.6	170	168	176	464	0.81	0.84	0.82	113.4	84.7%	
Total for Operating Pumps (% Full Load is a kW-weighted average)							433.6	78.8%			

No washout lances were operating at the time of these measurements, however, it is assumed that the load will remain the same because water is presently recirculated when no lances are operated and is not recirculated when the lances are in use.

Pump kW = Average Amps x Volts x √3 x Average Power Factor + 1,000

Percent Full Load = (Synchronous RPM - Measured RPM) + (Synchronous RPM - Full Load RPM)

Annual power consumption, based on operation 10 hours per day, 6 days per week is, thus:

1,352,872 kWH per year, or a cost of \$59,193 per year not including electrical demand charges. Note that the operating schedule used for this calculation assumes WADF is operated at its design capacity, present operations require fewer operating hours per year and fluctuate.

The following load profile is assumed based on observations of steamout building operations and on discussions with shift workers at building 117-6.

	% Load	Hr/ Day	Pump kW ¹	kWH per Year	_
•	0%	14	Off	0	
	10%	3	13.8	12,914	
	25%	2	34.5	21,524	
	50%	2	69.0	43,048	
	75%	2	103.5	64,572	
	100%	1	138.0	43,048	
S	ubtotai	24	•	185,108	per pump (4 each are always operating)
	Total, 4	l Pum	ps On	740,430	Total Annual Power Consumption

Note 1:

The efficiency of the Butterworth positive displacement pumps installed in this facility is constant. Load is proportional to flow.

Annual power savings are estimated at:

612,442 kWH / year, 4

45% of present power

usage by the high pressure pumps.

Annual operation and maintenance costs for the high pressure water pumps should be reduced because they are not operated at full capacity for extended periods. No cost benefit is taken for this assumption in order to provide a conservative analysis.

The concept has marginal economic analysis results and is, thus, <u>recommended for</u> implementation. Economic analysis results are summarized below on Table J-1.

The above retrofit assumes four pumps are operated during scheduled pump usage. Staged pump control is feasible and could save more energy. However, staged pump control would require cycling the high pressure pumps to follow the load. Motors of the size involved here cannot be cycled at the frequency required without being damaged, thus, pump cycling controls are not considered for this electric motor driven pump installation.

Replace Electric Motors on High Pressure Water Pumps with Internal Combustion Engines

High pressure pump drives could be replaced with internal combustion engines (ICE) to save energy costs. Use of ICEs would reduce electrical demand costs as well as usage costs as follows:

Present Power Consumption (before variable speed controls): 1,352,872 kWH/Yr
Present Electrical Demand of Electric Motor Drives (from measurements): 433.6 kW

ICEs that use No. 2 fuel oil are selected because natural gas is not available at WADF and propane tankage required would be prohibitively expensive.

Caterpillar Model 3306 Diesel Engine with Heavy Duty Clutch, Skid-Mounted with Day Tank
Full Load Fuel Consumption:
8.0 gph No. 2 Fuel Oil (138,700 BTU/gal)
1,109,600 BTUH
6.0 gph No. 2 Fuel Oil (138,700 BTU/gal)
832,200 BTUH

The load and energy use profile shown below assumes pumps are brought on line as the load increases. Assumptions are generous, allowing greater energy savings for this screening analysis than would likely be available in an actual installation.

	Hr/	ICE	No	Million	
% Load	Day	gph²	ON	BTU/Yr	_
0%	14	Off	0	0	
10%	3	6.0	1	778.9	
25%	2	8.0	1	692.4	
50%	2	8.0	2	1,384.8	
75%	2	8.0	3	2,077.2	
100%	1	8.0	4	1,384.8	_
Total	24	-		6,318	Total Annual No. 2 Fuel Oil Consumption

Note 2:

The above fuel oil consumption calculation is based on manufacturer's peak and part load performance data and assumes pumps are brought on line as the load increases.

Unlike the VFD retrofit addressed above, replacing the existing motor drives on the high pressure water pumps with internal combustion engines is a major modification, requiring construction of a new pump building or an extension to the existing building. In order to provide a plan with the least potential disruption to existing WADF operations, it is assumed that a new pump building is constructed next to the existing pump building (Building No. 117-6A). High pressure water pumps could be moved and then brought on line one-at-a-time to allow for uninterrupted operations.

Underground No. 2 fuel oil storage is also required for this retrofit. Assume that tankage for a 30-day supply is required: 146 gpd \times 30 days supply \times 4 = 17,520 gallons.

Diesel engines require considerably more maintenance than do the existing electric motors.

Assume O&M costs are only \$0.01 per HP-Hour of operation, or about: \$8,237 per year.

Table J-1. Summary of High Pressure Water Pump Drive Retrofit Evaluations

Economic Analysis Parameter	Install VFDs on Existing Motors	Replace Electric Motors with ICEs
Economic Life (per ECIP guidance): Investment:	20 Years \$168,767	20 Years \$513,722
Annual Energy Cost Saved: Annual O&M Cost Saved: Annual Non-Recurring Costs Saved: Total Annual (First Year) Cost Saved:	\$26,796 \$0 \$0 \$26,796	\$64,791 (\$8,237) (\$6,479) \$50,075
Life Cycle Energy Cost Saved: Life Cycle O&M Cost Saved: Life Cycle, Non-Recurring Cost Saved: Total Life Cycle Cost Saved:	\$404,089 \$0 \$0 \$404,089	\$841,919 (\$122,564) (\$96,408) \$622,947
Savings to Investment Ratio: Payback Period:	2.39 6.30 Years	1.21 10.26 Years

Recommended for Implementation

Life Cycle Cost Analysis Summary Energy Conservation Investment Program (ECIP)

Location:	Hawthorne Army		_		Project No.	
	Western Area De		•	DF), Neva	da	
Project Title:	ECIP Facility Ene Install Variable S			essure Wa		FY97 Iding 117-6A
Analysis Date:	November 1994				Preparer: KELL	_
1 1	0					
1. Investment						
A. Constructio	n Costs			50,684		
B. SIOH			\$	9,041		
C. Design Cost			\$	9,041		
D. Total Cost (\$ 1	68,767		
	ue of Existing Equ	•			<u> </u>	
	Company Rebate	•			<u> </u>	
G. Total Invest	ment (1D-1E-1F)					\$168,767
2. Energy Savi	ngs (+)/Cost(-):					
Date of NISTIF	85-3273 Used fo	or Discount Fac	tors: Oct	ober 1994		
Energy	Cost	Saving	An	nual \$	Discount	Discounted
Source	\$/MBTU(1)	MBTU/Yr(2)	Sav	rings(3)	Factor(4)	Savings(5)
A. Elec.	\$12.82	2,090	\$21	6,796	15.08	\$404,089
B. Dist	\$6.13	2,000	•	\$0	18.57	\$404,089 \$0
C. LPG	- +0.10	_	•	VO	18.57	40
D. Other	-	•	•			
E. Elec Deman	\$102.21	0.0	kW	\$0	15.08	\$0
F. Total		2,090.3		6,796	10.00	\$404,089
3 Non Energy	Savings (+) or C	oet (-):				
or tron Energy	Outrigs (1701 C	OSt (-).				
A. Annual Rec	urring (+/-)			\$0		
(1) Discount Fa	-				14.88	
	Savings/Cost (3A	x 3A1)				\$0
B. Non Recurri	ng Savings (+) or	Cost (-)				
Item	Savings $(+)$	Year of	Disco	ount	Discounted	
	Cost(-)(1)	Occur. (2)	Facto	or(3)	Savings(+) Co	st(-) (4)
a.					\$0	
b.		•			\$0	
c.					\$0	
d. Total	\$0				\$0	
C Total Non Er	ergy Discounted	Savings (3A2+	3Bd4)		\$0	
4. First Year D	ollar Savings (2F3	3+3A+(3Bd1/Y	ears Econ	omic Life))	: \$26,796	
5. Simple Payb					6.30	Years
6. Total Net Di	scounted Savings	(2F5 + 3C):			\$404,089	
	nvestment Ratio (2.39	

Life Cycle Cost Analysis Summary Energy Conservation Investment Program (ECIP)

Location:	Hawthorne Army		nt Region No. 4 ility (WADF), Nevada	Project No.	
Project Title:	ECIP Facility Ener	gy Improvements	•	Fiscal Year	¥97
		_	n Building 117-6A		
Analysis Date:	November 1994	Economic Life: 2	20 Years	Preparer: KELL	ER & GANNON
1. Investment	Costs				
A. Construction	n Costs		\$458,680		
B. SIOH			\$ 27,521		
C. Design Cos			\$ 27,521		
D. Total Cost			\$ 513,722	40	
-	ue of Existing Equi	-		\$0	
	y Company Rebate			\$0	_ ^542.722
G. Total Inves	tment (1D-1E-1F)				\$513,722
2. Energy Savi	ings (+)/Cost(-):				
Date of NISTIF	R 85-3273 Used fo	r Discount Factor	rs: October 1994		
Energy	Cost	Saving	Annual \$	Discount	Discounted
Source	\$/MBTU(1)	MBTU/Yr(2)	Savings(3)	Factor(4)	Savings(5)
A. Flan	412.02	4 617	¢50.102	15.00	6000 604
A. Elec.	\$12.82	4,617	\$59,193 (\$39,710)	15.08	\$892,624
B. Dist C. LPG	\$6.13	(6,318)	(\$38,719)	18.57	(\$719,016)
D. Other		-			
E. Elec Deman	d \$102.21		W \$44,318	15.08	\$668,310
F. Total	4102.21	(1,701)	\$64,791		\$841,919
r. Iulai		(1,701)	VO4,791		V041,313
3. Non Energy	Savings (+) or Co	st (-):			
A. Annual Rec	urring (+ /-)		(\$8,237)		
	actor (Table A)			14.88	
	Savings/Cost (3A	x 3A1)			(\$122,564)
		·			
B. Non Recurri	ng Savings (+) or	Cost (-)			
Item	Savings(+)	Year of	Discount	Discounted	
	Cost(-)(1)	Occur. (2)	Factor(3)	Savings(+) Co	st(-) (4)
a.	(\$129,581)	10	0.744	(\$96,408)	
b.					
c.					
d. Total	(\$129,581)			(\$96,408)	
C Total Non Er	nergy Discounted S	Savings (3A2+3E	3d4)	(\$218,972)	
4. First Year D	ollar Savings (2F3	+ 3A + (3Bd1/Yea	ars Economic Life)):	\$50,075	
5. Simple Payl		,		10.26	Years
	iscounted Savings	(2F5 + 3C):		\$622,947	
	Investment Ratio (S			1.21	
U ·	- •	•		•	

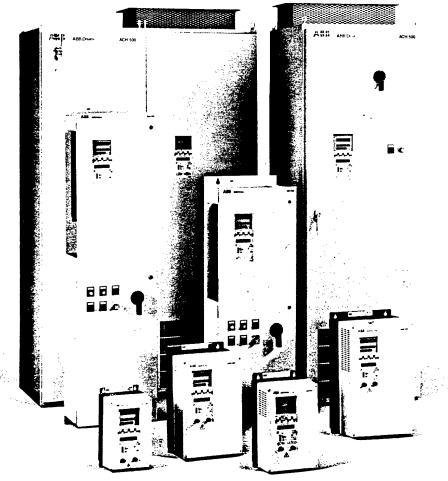
				Date Prepare	d	Sheet	of
CONSTRUCTION COST ESTIMATE					November-94 1		1
Project				Project No.	Basis for Est	imate	
ECIP Facility Energy Impr	oveme	nts					
Location Western Area Demili	tarizatio	on Faci	ity (WAE	OF)	7		
Hawthorne Army Amn	nunition	Plant,	Nevada		Code A (no	design compe	eted)
Engineer-Architect					1 '''		,
Keller & Gannon							
Drawing No.		Estimator			Checked By		
		<u> </u>	BIH			RCL	
	Qu	antity	ι	.abor	Ma	iterial	
Line Item	No.	Unit	Per		Per		Total
	Units	Meas.	Unit	Total	Unit	Total	Cost
Building 117-6A: Install Variab	le Spe	ed Driv	es to Co	ontrol Hig	h Pressu	re Water	Pumps
Install ABB Model ACH-500 Variable	5	EA	\$1,500	\$7,500	\$18,700	\$93,500	\$101,000
Frequency Drives on 150HP Motors			\$1,000	Ψ1,000	\$10,700	Ψ93,300	\$101,000
Differential Pressure Controller to	1 1	EA	\$ 165	\$165	\$350	\$350	\$515
Modulate Pump Speed	· · · · ·		*				\$515
Pressure Sensor, Electric Operated	1	EA	\$60.85	\$61	\$518.56	\$519	\$579
Conduit and Wiring Allowance	1	Job	\$1,298	\$1,298	\$1,000	\$1,000	\$2,298
Subtotal	0.750			\$9,024		\$95,369	\$104,393
Nevada Sales Tax	3.75%	%		-		\$3,576	\$3,576
Subtotal	05.004				<u> </u>		\$107,969
Contractor OH & Profit	25.0%	%					\$26,992
Subtotal							\$134,961
Bond	1.5%	%					\$2,024
Subtotal							\$136,986
Estimating Contingency	10.0%	%					\$13,699
Total Probable Construction C	ost			·	•		\$150,684

				Date Prepared		Sheet	of
CONSTRUCTION COS	ST EC.	TINAAT	Γ Ε	Novem		1	1
	CONSTRUCTION COST ESTIMATE					<u> </u>	•
Project FOLD For III'd For a series leading		.4.		Project No.	Basis for Est	imate	
ECIP Facility Energy Impro	ovemer	its	: (\A/A D		ł		
Location Western Area Demilit)F)			
Hawthorne Army Amm	unition	Plant,	Nevada		Code A (no	design compet	ed)
Engineer-Architect							
Keller & Gannon					Observat Dec		
Drawing No.		Estimator	він		Checked By	RCL	
	<u> </u>						ı
	Qua	ntity	L	abor	Ma	aterial	
Line Item	No.	Unit	Per		Per	1	Total
	Units	Meas.	Unit	Total	Unit	Total	Cost
Building 117-6A: Retrofit Inter	nal Cor	nbusti	on Engir	nes on Hid	h Pressi	ure Water	Pumps
	1 1		<u></u>		1	I	
15,000 Gal Fiberglass Underground	1 1	EA	\$3,555	\$3,555	\$14,287	\$14,287	\$17,842
Double-Wall Tank, incl. manways			60.057	62.057	\$0.00	\$0	\$3,057
Tank Excavation and Backfill	1	Job	\$3,057	\$3,057 \$102		\$529	\$3,03 <i>1</i> \$631
Fuel Oil Circulation Pump 36 gph	1	EA	\$101.59	\$102	\$529.25	\$529	\$001
Tank/Piping Leak Detection	1	EA	\$162	\$162	\$1,737	\$1,737	\$1,900
Controller, 8 Channel, monitoring							
Secondary Containment	1 1	EA	\$85	\$85	\$920	\$920	\$1,004
Hydrocarbon Liquid & Vapor Probe						-	
Tank Annular Space Monitoring Well,	1 1	EA	\$85	\$85	\$684	\$684	\$769
Chemical Monitoring Tank Internals, allowance	1	Job	\$169	\$169	\$1,500	\$1,500	\$1,669
Fuel Piping, 2-inch Service & 3-inch	†*****		1		1		
Containment, FRP Pipe & Fittings	200	LF	\$8.71	\$1,742	\$29.81	\$5,963	\$7,704
Caterpillar Diesel Engine Drive &							
Heavy Duty Clutch: MN 3306	5	EA	\$1,016	\$5,080	\$24,000	\$120,000	\$125,080
Differential Pressure Controller to			<u> </u>				
Modulate Pump Speed	1	EA	\$165	\$165	\$350	\$350	\$515
Pressure Sensor, Electric Operated	1	EA	\$60.85	\$61	\$518.56	\$519	\$579
Conduit and Wiring Allowance	1	Job	\$1,298	\$1,298	\$1,000	\$1,000	\$2,298
High Pressure Piping Modifications	370	LF	\$33.22	\$12,290	\$87.67	\$32,440	\$44,729
Reset Pumps from Building 117-6A					\$750	\$2.750	\$10.240
to New Pump Building	5	EA	\$1,298	\$6,490		\$3,750	\$10,240
New Building, complete	2,000	SF	Inc	luded	\$50	\$100,000	\$100,000
Subtotal				\$34,340		\$283,678	\$318,018
Nevada Sales Tax	3.75%	%		-		\$10,638	\$10,638
Subtotal							\$328,656
Contractor OH & Profit	25.0%	%					\$82,164
Subtotal							\$410,820
Bond	1.5%	%					\$6,162
Subtotal							\$416,982
Estimating Contingency	10.0%	%					\$41,698
Total Probable Construction C			I	1		<u> </u>	\$458,680

Internal combustion engines in the type of service anticipated are assumed to require replacement about every 10 years. Costs for engine replacements only per above \$129,581 each 10 years.

ACH 500 SeriesAdjustable Frequency AC Drives

Product Bulletin ACH500-02A



The ACH 500 series is a microprocessor based Pulse Width Modulated (PWM) adjustable frequency AC drive. The ACH 500 drive takes advantage of sophisticated microprocessor control and advanced IGBT power switching technology to deliver high-performance control of AC motors for varied HVAC applications.

With drives ranging from 2 to 400 HP, the ACH 500 series features a universal alphanumeric interface that "speaks" to the operator in plain English phrases, greatly simplifying set-up, operation, and fault diagnosis.

Each ACH 500 drive comes equipped with a library of pre-programmed application macros, which at a touch of a button, allow rapid configuration of inputs, outputs, and performance parameters for your HVAC applications to maximize convenience and minimize start-up time.

The ACH 500 series can handle the most demanding HVAC applications in an efficient, dependable, and economic manner.



Effective 4/1/93 Supersedes 6/15/92

Product Bulletin ACH500-02A



AUD DUU **HVAC AC DRIVES**

FEATURES

STANDARD FEATURES

- UL Listed
- CSA (Applied For)
- 40 Character Multi-lingual Alphanumeric Display
 - Output Frequency
 - Speed (RPM, %, or user programmable)
 - Motor Current
 - Calculated Motor Torque
 - Calculated Motor Power
 - DC Bus Voltage
 - Output Voltage
 - Heatsink Temperature (°F & °C)
 - · Elapsed Time Meter
 - kWh Meter
 - Parameter Data
 - Fault Text
 - Warning Text
 - Supervision Text
- RS-485 Communications
- Two (2) Analog Inputs
- Six (6) Programmable Digital Inputs
- Two (2) Programmable Analog Outputs
- Three (3) Programmable Form C Relay Outputs
- Adjustable Filters On Analog Inputs and Outputs
- Input Speed Signals

Current 0(4)-20 mA Voltage 0(2)-10 VDC

Increase/Decrease Speed Contacts

RS-485 Communications

- Start/Stop
 - 2 Wire (Dry Contact Closure)
 - 3 Wire (Momentary Dry Contacts)
 - Application Of Input Power
- All Control Inputs Isolated From Ground and Power
- **Protection Circuits**

Over Current

Ground Fault

Over Voltage

Under Voltage

Over Temperature

Adaptable Electronic Motor Overload (12t)

- Input Line Fuses
- Stall Protection
- **Underload Function**
- Three (3) Current Limit Circuits
- Electronic Reverse
- Rapid Reverse
- DC Injection Braking
- DC Hold
- Auto Restart-Customer Selectable and Adjustable
- Two (2) Independently Adjustable Accel and Decel Ramps
- Linear Or three (3) "S" Curve Accel/Decel Ramps
- Ramp Or Coast To A Stop

Product Bulletin ACS500-02A

- Programmable Maximum Frequency To 500 Hz (ACH 501)
- Integral Programmable PI Setpoint Controller
- Mathematical Functions on Analog Signals
- Seven (7) Preset Speeds
- Five (5) Critical Frequency Lockout Bands
- V/Hz Shape

Linear

Squared

Automatic

Start Functions

Ramp

Flying Start

Automatic Torque Boost

- Automatic Slip Compensation (selectable)
- IR Compensation Manual or Automatic
- Automatic Extended Power Loss Ride Through (selectable)
- DC Line Reactor

OPTIONAL FEATURES

- Disconnect Switch
- Circuit Breaker
- Manual Bypass
- **Automatic Bypass**
- Service Switch
- Motor Overload Relay(s)
- Analog Meters
- 115 VAC Control Interface
- AC Line Reactors
- Intelligent Remote Keypad/Display Panel
- Pressure (3-15 psi) to Electric Transducer
- Digital Input Isolators



SPECIFICATIONS

■ Two programmable Analog Inputs: Voltage reference: 0 to 10 V, 200k ohm single ended Current reference: 0 to 20 mA, 250 ohms single ended Potentiometer: 10 VDC, 10 mA (1K to 10K ohms) Auxiliary voltage: +24 VDC, max 200 mA Six Programmable Digital Inputs: 24 VDC Two Programmable Analog Outputs: 0 (4) to 20 mA, 500 ohm maximum load	Input Connection	
Prequency		
Power factor: For fundamental	Frequency	48 63 Hz
Output votage:	Power factor: For fundamental	~ 0.98
Prequency resolution 12 BiT - analog input 2 10 BiT - analog input 3 10 BiT - analog input 3 10 BiT - analog input 3 10 BiT - analog input 4 10 BiT - analog input 4 10 BiT - analog input 5 10 BiT - analog input 5 10 BiT - analog input 6 10 BiT - analog input 6 10 BiT - analog input 7 10 BiT - analog input 7 10 BiT - analog input 7 10 BiT - analog input 8 10 BiT - analog input 9 10 BiT - analog in		
Prequency resolution 12 BiT - analog input 2 10 BiT - analog input 3 10 BiT - analog input 3 10 BiT - analog input 3 10 BiT - analog input 4 10 BiT - analog input 4 10 BiT - analog input 5 10 BiT - analog input 5 10 BiT - analog input 6 10 BiT - analog input 6 10 BiT - analog input 7 10 BiT - analog input 7 10 BiT - analog input 7 10 BiT - analog input 8 10 BiT - analog input 9 10 BiT - analog in	Output voltage:	3φ 0 to V _{IN} (V _{max} at field weakening point)
Prequency resolution 12 BiT - analog input 2 10 BiT - analog input 3 10 BiT - analog input 3 10 BiT - analog input 3 10 BiT - analog input 4 10 BiT - analog input 4 10 BiT - analog input 5 10 BiT - analog input 5 10 BiT - analog input 6 10 BiT - analog input 6 10 BiT - analog input 7 10 BiT - analog input 7 10 BiT - analog input 7 10 BiT - analog input 8 10 BiT - analog input 9 10 BiT - analog in	Output frequency:	0 to 500 Hz (ACH 501), 0 to 120 Hz (ACH 502)
Switching frequency f₂	Frequency resolution:	0.01 Hz Digital, 0 to 120 Hz; 0.1 Hz >120 Hz
Switching frequency f₂		12 BIT - analog input 2
Continuous output current: Variable torque: □ Overload Capacity: Variable torque: □ Starting duty: Field weakening point: □ Acceleration time: □ Deceleration time: □ 1.1 x I _{RSO} , for 1 min every 10 min Approx. 1.4 x I _{RSO} for 2 see every 15 sec Field weakening point: □ 3.0 to 500 Hz (ACH 501), 30 to 180 Hz (ACH 502) Acceleration time: □ 0.1 to 1800 sec. □ Deceleration time: □ 1.0 to 1800 sec. □ Deceleration time: □ 1.0 to 1800 sec. □ Deceleration time: □ 2.1 to 1800 sec. □ NEMA 12, NEMA 1, chassis ■ Invironmental limits: Ambient operating temperature (f _a =3 kHz): Variable torque: □ 32 to 104°F (0 to 40°C) NEMA 1 Variable torque: □ 32 to 104°F (0 to 40°C) NEMA 1 Variable torque: □ 32 to 104°F (0 to 40°C) NEMA 1 Variable torque: □ 32 to 104°F (0 to 40°C) NEMA 1 Variable torque: □ 32 to 104°F (0 to 40°C) NEMA 1 Variable torque: □ 32 to 104°F (0 to 40°C) NEMA 1 Variable torque: □ 32 to 104°F (0 to 40°C) NEMA 1 Variable torque: □ 32 to 104°F (0 to 40°C) NEMA 1 Variable torque: □ 32 to 104°F (0 to 40°C) NEMA 1 Variable torque: □ 32 to 104°F (0 to 40°C) NEMA 1 Variable torque: □ 32 to 104°F (0 to 40°C) NEMA 1 Variable torque: □ 32 to 104°F (0 to 40°C) NEMA 1 Variable torque: □ 32 to 104°F (0 to 40°C) NEMA 1 Variable torque: □ 32 to 104°F (0 to 40°C) NEMA 1 Variable torque: □ 32 to 104°F (0 to 40°C) NEMA 1 Variable torque: □ 32 to 104°F (0 to 40°C) NEMA 1 Variable torque: □ 32 to 104°F (0 to 40°C) NEMA 1 Variable torque: □ 400 to 45°F (40 to 40°C) NEMA 1 Variable torque: □ 400 to 45°F (40 to 40°C) NEMA 1 Variable torque: □ 400 to 45°F (40 to 40°C) NEMA 1 Variable torque: □ 400 to 45°F (40 to 40°C) NEMA 1 Variable torque: □ 400 to 45°F (0 to 40°C) NEMA 1 Variable torque: □ 400 to 45°F (0 to 40°C) NEMA 1 Variable torque: □ 400 to 45°F (0 to 40°C) NEMA 1 Variable torque: □ 400 to 45°F (0 to 40°C) NEMA 1 Variable torque: □ 400 to 45°F (0 to 40°C) NEMA 1 Variable torque: □ 400 to 45°F (0 to 40°C) NEMA 1 Variable torque: □ 400 to 45°F (0 to 40°		10 BIT - analog input 1
Continuous output current:	Switching frequency f _s	1.0 to 12.0 kHz (ACH 501) factory set at 3kHz
Variable torque:	Continuous output ourrents	3.0 kHz (ACH 502)
Variable torque:	Variable torque:	Detect 1 (Detect surrout Mariette Tour a)
Variable torque:	Variable torque	Hated I _{RSQ} (Hated current, Variable Torque)
Statring dutly:		1.1 v.l. for 1 min array 10 min
Fleid weakening point. 30 to 500 Hz (ACH 501), 30 to 180 Hz (ACH 502)	Starting duty:	Approved A video for O and overvide and
■ Acceleration time: Deceleration time: Deceleration time: Deceleration time: O.1 to 1800 sec. ■ Enclosure: NEMA 12, NEMA 1, chassis ■ Invironmental limits: Ambient operating temperature (f₃=3 kHz): Variable torque: 32 to 95°F (0 to 35°C) NEMA 12 Storage temperature: -40 to +150°F (-40 to +70°C) Cooling method: Integral fan(s) Relative humidity: max 95%, no condensation allowed Altitude: max 3300 ft. (1000 m) above sea level (100% load) 1% derating every 330 ft. above 3300 ft. ■ Agency Approval: ■ Two programmable Analog Inputs: Voltage reference: O to 10 V, 200k ohm single ended Current reference: O to 20 mA, 250 ohms single ended Potentiometer: I VDC, 10 mA (1K to 10K ohms) ■ Xix Programmable Polital inputs: Six Programmable Analog Outputs: Three Programmable Analog Outputs: Three Programmable Analog Outputs: Three Programmable Analog Outputs: Three Programmable Analog Outputs: Aux switching voltage: Three Programmable Selay (Form C) Outputs: Max switching outrent: Max switching ourrent: As xwitching ourrent: As X24 VDC Ax switching ourrent: A 8 X24 VDC, 0 a 4/250 VDC Max switching ourrent: 2A Protections: Overcurrent trip limit: 315% instantaneous, 225% (RMS) Slow current regulation limit: 170% (RMS) max. Rapid current regulation limit: 110% instantaneous, 175% (RMS) ACH 501 315% instantaneous, 225% (RMS) ACH 501 315% instantaneous, 175% (RMS) ACH 501 315% instantaneous, 225% (RMS) ACH 501 Microprocessor fault: Protected Motor stall protection. Protected Motor stall protection. Protected Motor voltage: Anotor voltage: Anotor voltage: Anotor voltage: Anotor circuit Protected Motor stall protection. Protected Motor voltage: Protected	Field weakening point:	
■ Deceleration time: .0.1 to 1800 sec. Enclosure: NEMA 12, NEMA 1, chassis ■ Environmental limits: Ambient operating temperature (f₃=3 kHz): Variable torque: .32 to 95°F (0 to 35°C) NEMA 12 Storage temperature: .40 to +150°F (-40 to +70°C) Cooling method: Integral fan(s) Relative humidity: max 95%, no condensation allowed Altitude: max .3300 ft. (1000 m) above sea level (100% load) 1% derating every 330 ft. above 3300 ft. .100 m) above sea level (100% load) ■ Agency Approval. UL, CSA Applied For External Control Connections .10 to 10 V, 200k ohm single ended Current reference: .0 to 20 mA, 250 ohms single ended Current reference: .0 to 20 mA, 250 ohms single ended Potentiometer. .10 VDC, 10 mA (1K to 10K ohms) ■ Auxiliary voltage: +24 VDC, max 200 mA ■ Six Programmable Analog Outputs: .0 (4) to 20 mA, 500 ohm maximum load ■ Three Programmable Relay (Form C) Outputs: .0 (4) to 20 mA, 500 ohm maximum load ■ Three Programmable Analog Outputs: .0 (4) to 20 mA, 500 ohm maximum load ■ Three Programmable Relay (Form C) Outputs: .0 (3) to 20 m	Acceleration time:	30 to 300 Hz (ACH 301), 30 to 180 Hz (ACH 502)
■ Enclosure: ■ Environmental limits: Ambient operating temperature (f₂=3 kHz): Variable torque: 32 to 95°F (0 to 40°C) NEMA 12 Storage temperature: 40 to +158°F (-40 to +70°C) Cooling method: Inlegral fan(s) Relative humidity: Max 95%, no condensation allowed Altitude: max 3300 ft. (1000 m) above sea level (100% load) 3300 ft. (1000 m) above sea level (100% load) 1% derating every 330 ft. above 3300 ft. UL, CSA Applied For External Control Connections ■ Two programmable Analog Inputs: Voltage reference: 0 to 20 mA, 250 ohms single ended Current reference: 0 to 20 mA, 250 ohms single ended Potentiometer: 10 VDC, 10 mA (1fk to 10K ohms) ■ Auxiliary voltage: 24 VDC Two Programmable Digital Inputs 24 VDC Two Programmable Banalog Outputs: 0 (4) to 20 mA, 500 ohm maximum load ■ Three Programmable Relay (Form C) Outputs: Max switching ourrent 8 A/24 VDC, 0.4 A/250 VDC Max switching ourrent Max continuous current 2A Protections: Overcurrent trip limit: 115% instantaneous, 225% (RMS) Slow current regulation limit: 125% (RMS) max. Current switch-off limit: 255% instantaneous, 175% (RMS) ACH 501 315% instantaneous, 225% (RMS) ACH 502 Overtemperature regulation limit: 130% Overtemperature (heatsink): 4158°F (+70°C) ACH 501; At Start (ACH 502) Microprocessor fault: Protected Motor stall protection Protected Motor stall protection First Hard 12 Achieved Motor overtemperature protection (P³1). Protected Motor overtemperature protection (P³1). Protected Motor overtemperature protection (P³1). Protected	■ Deceleration time:	0.1 to 1900 sec.
■ Environmental limits: Ambient operating temperature (f _s =3 kHz): Variable torque: 32 to 95°F (0 to 35°C) NEMA 1 Variable torque: 32 to 95°F (0 to 35°C) NEMA 1 Variable torque: 40 to +158°F (40 to +70°C) Cooling method: Integral fan(s) Relative humidity: max 95%, no condensation allowed Altitude: max 3300 ft. (1000 m) above sea level (100% load) 1% derating every 330 ft. above 3300 ft. UL, CSA Applied For External Control Connections Two programmable Analog Inputs: Voltage reference: 0 to 10 V, 200k ohm single ended Current reference: 0 to 20 mA, 250 ohms single ended Current reference: 10 VDC, 10 mA (1K to 10K ohms) Auxiliary voltage: 424 VDC Two Programmable Analog Outputs: 1 Two Programmable Relay (Form C) Outputs: Max switching voltage. 300 VDC/250 VAC Max switching current: 8 A/24 VDC, o. 4 A/250 VDC Max switching current: 8 A/24 VDC, o. 4 A/250 VDC Max switching current: 8 A/24 VDC, o. 4 A/250 VDC Aux switching current: 9 A/24 VDC, o. 4 A/250 VDC Aux switching current: 8 A/24 VDC, o. 4 A/250 VDC Aux switching current: 9 A/250 VAC Aux switching current: 9 A/26 VDC, o. 4 A/250 VDC Aux switching current: 2 A Protections: Overcurrent trip limit: 315% instantaneous, 225% (RMS) Slow current regulation limit: 125% (RMS) max. Current switch-off limit: 255% instantaneous, 775% (RMS) ACH 501 315% instantaneous, 775% (RMS) ACH 502 Auxiliary voltage: Short Circuit Protected Ground fault: Hunning (ACH 501); At Start (ACH 502) Microprocessor fault: Protected Motor stall protection Motor overtemperature protection (I²1). Protected Motor voltage in plane in the circuit Protected Motor voltage in plane in the circuit Protected Motor voltage in plane in the circuit Protected Motor voltage in plane in the circuit Protected Motor voltage in plane in the circuit Protected Motor voltage in plane in the circuit Protected Motor voltage in plane in the circuit Protected Motor voltage in plane in the circuit Protected Motor voltage in plane in the circuit pl	■ Enclosure:	
Ambient operating temperature (f₂=3 kHz): Variable torque: 32 to 95°F (0 to 35°C) NEMA 1 Variable torque: 32 to 95°F (0 to 35°C) NEMA 12 Storage temperature:	Fryironmental limits:	
Variable torque:		
Variable torque:		32 to 104°E (0 to 40° C) NIEMA 1
Storage temperature:	Variable torque:	32 to 95°F (0 to 35°C) NEMA 12
Cooling method: Integral fan(s) Relative humidity: max 95%, no condensation allowed Altitude: max 3300 ft. (1000 m) above sea level (100% load) 1% derating every 330 ft. above 3300 ft. ■ Agency Approval UL, CSA Applied For External Control Connections ■ Two programmable Analog Inputs: Voltage reference: 0 to 10 V, 200k ohm single ended Current reference: 0 to 20 mA, 250 ohms single ended Potentiometer: 10 VDC, 10 mA (11k to 10K ohms) ■ Auxiliary voltage: +24 VDC, max 200 mA Six Programmable Digital Inputs 24 VDC ■ Two Programmable Analog Outputs: 0 (4) to 20 mA, 500 ohm maximum load ■ Three Programmable Relay (Form C) Outputs: Max switching voltage: 300 VDC/250 VAC Max switching ourrent 8 A/24 VDC, 0.4 A/250 VDC Max switching ourrent 8 A/24 VDC, 0.4 A/250 VDC Max switching power 2000 VA/250 VAC Max continuous current 2A Protections: Overcurrent trip limit: 125% (RMS) max. Rapid current regulation limit: 170% (RMS) max. Rapid current regulation limit: 170% (RMS) max. Current switch-off limit: 255% instantaneous, 225% (RMS) ACH 501 Overvoltage trip limit: 130% Undervoltage trip limit: 130% Undervoltage trip limit: 65% Overneperature (heatsink): +158*F (+70*C) ACH 501, +185*F (+85*C) ACH 502 Auxiliary voltage: Short Circuit Protected Motor overtemperature protection (I°t) Protected Motor overtemperature protection (I°t) Protected Motor overtemperature protection (I°t) Protected	Storage temperature:	-40 to ±158*F (-40 to ±70*C)
Relative humidity: max 95%, no condensation allowed Altitude: max 3300 ft. (1000 m) above sea level (100% load) Agency Approval	Cooling method:	Integral fan(s)
Altitude: max	Relative humidity:	max 95%, no condensation allowed
Agency Approval	Altitude: max	3300 ft. (1000 m) above sea level (100% load)
External Control Connections Two programmable Analog Inputs: Voltage reference: Oto 20 mA, 250 ohms single ended Potentiometer: 10 VDC, 10 mA (1K to 10K ohms) Auxiliary voltage: 10 VDC, 10 mA, 500 ohms maximum load Auxiliary voltage: 10 VDC, 10 mA, 500 ohm maximum load Three Programmable Digital Inputs: 24 VDC Two Programmable Analog Outputs: 0 (4) to 20 mA, 500 ohm maximum load Three Programmable Belay (Form C) Outputs: Max switching voltage: 300 VDC/250 VAC Max switching outrent: 8 A/24 VDC, 0.4 A/250 VDC Max switching power: 2000 VA/250 VAC Max continuous current: 2A Protections: Overcurrent trip limit: 315% instantaneous, 225% (RMS) Slow current regulation limit: 125% (RMS) max. Rapid current regulation limit: 170% (RMS) max. Current switch-off limit: 255% instantaneous, 175% (RMS) ACH 501 315% instantaneous, 225% (RMS) ACH 502 Overvoltage trip limit: 130% Undervoltage trip limit: 130% Undervoltage: Short Circuit Protected Ground fault: Running (ACH 501); At Start (ACH 502) Microprocessor fault: Protected Motor overtemperature protection (f²t). Protected		1% derating every 330 ft. above 3300 ft.
Two programmable Analog Inputs: Voltage reference:	Agency Approval	UL, CSA Applied For
Voltage reference: 0 to 10 V, 200k ohm single ended Current reference: 0 to 20 mA, 250 ohms single ended Potentiometer 10 VDC, 10 mA (1K to 10K ohms) Auxiliary voltage: +24 VDC, max 200 mA Six Programmable Digital Inputs 24 VDC Two Programmable Relay (Form C) Outputs: 0 (4) to 20 mA, 500 ohm maximum load Three Programmable Relay (Form C) Outputs: Max switching voltage 300 VDC/250 VAC Max switching voltage 300 VDC/250 VAC Max switching power 2000 VA/250 VAC Max switching power 2000 VA/250 VAC Max continuous current 2A Protections: 315% instantaneous, 225% (RMS) Slow current regulation limit: 125% (RMS) max. Rapid current regulation limit: 170% (RMS) max. Current switch-off limit: 255% instantaneous, 175% (RMS) ACH 501	External Control Connections	
Voltage reference: 0 to 10 V, 200k ohm single ended Current reference: 0 to 20 mA, 250 ohms single ended Potentiometer 10 VDC, 10 mA (1K to 10K ohms) Auxiliary voltage: +24 VDC, max 200 mA Six Programmable Digital Inputs 24 VDC Two Programmable Relay (Form C) Outputs: 0 (4) to 20 mA, 500 ohm maximum load Three Programmable Relay (Form C) Outputs: Max switching voltage 300 VDC/250 VAC Max switching voltage 300 VDC/250 VAC Max switching power 2000 VA/250 VAC Max switching power 2000 VA/250 VAC Max continuous current 2A Protections: 315% instantaneous, 225% (RMS) Slow current regulation limit: 125% (RMS) max. Rapid current regulation limit: 170% (RMS) max. Current switch-off limit: 255% instantaneous, 175% (RMS) ACH 501	■ Two programmable Analog Inputs:	
Current reference: 0 to 20 mA, 250 ohms single ended Potentiometer 10 VDC, 10 mA (1K to 10K ohms) Auxiliary voltage: +24 VDC, max 200 mA Six Programmable Digital Inputs 24 VDC Two Programmable Analog Outputs: 0 (4) to 20 mA, 500 ohm maximum load Three Programmable Relay (Form C) Outputs: Max switching voltage 300 VDC/250 VAC Max switching voltage 2000 VA/250 VAC Max switching power 2000 VA/250 VAC Max continuous current 2A Protections: 0vercurrent trip limit: 315% instantaneous, 225% (RMS) Slow current regulation limit: 125% (RMS) max. Rapid current regulation limit: 170% (RMS) max. Rapid current regulation limit: 255% instantaneous, 175% (RMS) ACH 501 Current switch-off limit: 255% instantaneous, 225% (RMS) ACH 502 Overvoltage trip limit: 130% Undervoltage trip limit: 130% Undervoltage trip limit: 65% Overtemperature (heatsink): +158°F (+70°C) ACH 501, +185°F (+85°C) ACH 502 Auxiliary voltage: Short Circuit Protected Ground fault: Running (ACH 501); At Start (ACH 502) Microprocessor fault: Protected Motor overtemperature protection (I²t) Protected Motor overtemperature protection (I²t) Protected	Voltage reference:	0 to 10 V 200k ohm single ended
Potentiometer	Current reference:	0 to 20 mA, 250 ohms single ended
Auxiliary voltage: +24 VDC, max 200 mA Six Programmable Digital Inputs 24 VDC Two Programmable Analog Outputs: 0 (4) to 20 mA, 500 ohm maximum load Three Programmable Relay (Form C) Outputs: Max switching voltage 300 VDC/250 VAC Max switching current 8 A/24 VDC, 0.4 A/250 VDC Max switching power 2000 VA/250 VAC Max continuous current 2A Protections: Overcurrent trip limit: 315% instantaneous, 225% (RMS) Slow current regulation limit: 125% (RMS) max. Rapid current regulation limit: 170% (RMS) max. Current switch-off limit: 255% instantaneous, 175% (RMS) ACH 501 315% instantaneous, 225% (RMS) ACH 502 Overvoltage trip limit: 130% Undervoltage trip limit: 55% Overtemperature (heatsink): +158*F (+70*C) ACH 501, +185*F (+85*C) ACH 502 Auxiliary voltage: Short Circuit Protected Ground fault: Running (ACH 501); At Start (ACH 502) Microprocessor fault: Protected Motor stall protection. Protected Motor overtemperature protection (I²t). Protected	Potentiometer	10 VDC. 10 mA (1K to 10K ohms)
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Two Programmable Analog Outputs: 0 (4) to 20 mA, 500 ohm maximum load Three Programmable Relay (Form C) Outputs: Max switching voltage 300 VDC/250 VAC Max switching current 8 A/24 VDC, 0.4 A/250 VDC Max switching power 2000 VA/250 VAC Max continuous current 2A Protections: Overcurrent trip limit: 315% instantaneous, 225% (RMS) Slow current regulation limit: 125% (RMS) max. Rapid current regulation limit: 170% (RMS) max. Current switch-off limit: 255% instantaneous, 175% (RMS) ACH 501 315% instantaneous, 225% (RMS) ACH 502 Overvoltage trip limit: 130% Undervoltage trip limit: 55% Overtemperature (heatsink): +158*F (+70*C) ACH 501, +185*F (+85*C) ACH 502 Auxiliary voltage: Short Circuit Protected Ground fault: Running (ACH 501); At Start (ACH 502) Microprocessor fault: Protected Motor stall protection. Protected Motor overtemperature protection (l²t). Protected	Six Programmable Digital Inputs	24 VDC
Three Programmable Relay (Form C) Outputs: Max switching voltage	■ Two Programmable Analog Outputs:	0 (4) to 20 mA, 500 ohm maximum load
Max switching current 8 A/24 VDC, 0.4 A/250 VDC Max switching power 2000 VA/250 VAC Max continuous current 2A Protections: 315% instantaneous, 225% (RMS) Slow current regulation limit: 125% (RMS) max. Rapid current regulation limit: 170% (RMS) max. Current switch-off limit: 255% instantaneous, 175% (RMS) ACH 501 Overvoltage trip limit: 130% instantaneous, 225% (RMS) ACH 502 Overvoltage trip limit: 130% (RMS) ACH 502 Overtemperature (heatsink): +158*F (+70*C) ACH 501, +185*F (+85*C) ACH 502 Auxiliary voltage: Short Circuit Protected Ground fault: Running (ACH 501); At Start (ACH 502) Microprocessor fault: Protected Motor stall protection Protected Motor overtemperature protection (I²t) Protected	Three Programmable Relay (Form C) Outputs:	
Max switching power	Max switching voltage	300 VDC/250 VAC
Max continuous current		
Protections: Overcurrent trip limit:		
Overcurrent trip limit:		2A
Slow current regulation limit:		OAFOL!
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Current switch-off limit:	Panid current regulation limit:	125% (MM5) max.
	Current switch-off limit:	170% (RIVIS) IIIAX.
Overvoltage trip limit:	Current Switch-on limit.	315% instantaneous, 175% (MMS) ACH 501
Undervoltage trip limit:	Overvoltage trip limit	130%
Overtemperature (heatsink):		
Auxiliary voltage: Short Circuit Protected Ground fault: Running (ACH 501); At Start (ACH 502) Microprocessor fault: Protected Motor stall protection. Protected Motor overtemperature protection (I²t). Protected	Overtemperature (heatsink):	+158°F (+70°C) ACH 501 +185°F (+85°C) ACH 502
Ground fault:	Auxiliary voltage:	Short Circuit Protected
Microprocessor fault: Protected Motor stall protection Protected Motor overtemperature protection (1²t) Protected	Ground fault:	Bunning (ACH 501): At Start (ACH 502)
Motor stall protectionProtected Motor overtemperature protection (I²t)Protected	Microprocessor fault:	Protected
Motor overtemperature protection (I ² t)Protected		
	AC Line Fuses	Standard

Specifications are subject to change without notice. Consult factory when specifications are critical.

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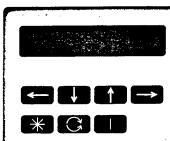
DRIVE FEATURES - OPERATOR INTERFACE

2-Line, 40-Character, Multilingual Alphanumeric Display

Highly legible liquid crystal display (LCD) can access more than 120 parameter names, 330 values (including energy consumption and elapsed time), plus an array of fault and warning messages. The ACH 500 presents this information in "plain" English (no codes) (or 8 other user-selected languages, including: French, Spanish, German, Italian, Swedish, Finnish, Danish and Dutch).

■ Keypad Control Panel

ACH 500 drives are equipped with an easily recognizable seven (7) button digital keypad, which allows error-free programming, data input, and operator interface via the front face of the drive.



■ Parameters Organized into Groups

The parameters in the ACH 500 are organized into functional groups and are accessed via a system of menus, rather than having to step through hundreds of parameters sequentially. This makes finding the right parameter much easier and quicker.

Application Macros

The ACH 500 offers a choice of four (4) HVAC application macros and has been designed to offer users the ability to program common applications in a simple and flexible manner. By using the application macros supplied as standard with all ACH 500's, building-wide standardization will be greatly simplified.

These macros allow for complete configuring of the analog and digital I/O's, and certain drive parameters for specific applications. In addition, the function of each of the analog or digital I/O's or drive parameters may be customized, providing added flexibility.

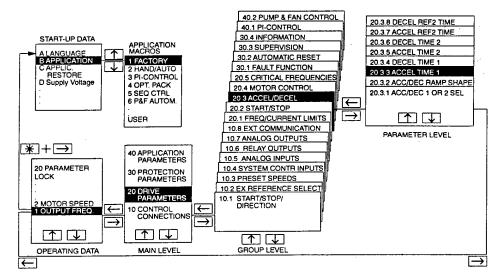
Programmable Analog and Digital Inputs and Outputs

Two analog and six digital inputs along with two analog and three relay (Form C) outputs, all programmable, are standard on the ACH 500.

Interfacing with direct digital controllers (DDC), programmable logic controllers (PLC's) or other high level automation systems is accomplished by means of the ACH 500's standard control interface card. This card provides for two analog and six digital inputs, along with two analog and three relay (Form C) outputs, all programmable.

■ Customer Terminal Strip

The common circuit potential of the customer terminal strip is optically isolated from power circuits, and resistively isolated from the chassis by a 10 Megohm resistor.



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DRIVE FEATURES - OPERATOR INTERFACE (cont'd)

Serial Communication

RS-485 serial communications port to support a Remote Panel, as well as PC and PLC for monitoring and control is standard on the ACH 500.

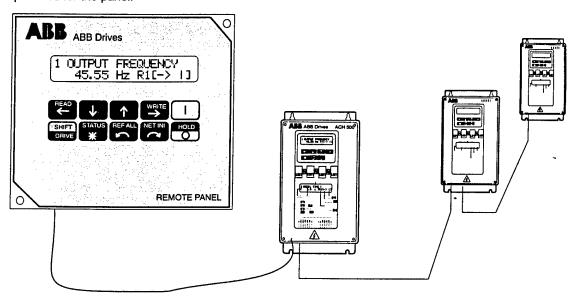
■ Remote Panel (Optional)

The Remote Panel is a Keypad/Display that provides the the same alpha-numeric display and functionality as the standard local panel mounted on the ACS 500. This panel can be mounted at a remote location.

The Remote Panel can be used with any ACH 500 drive manufactured after January 1993. One panel can control up to 31 ACH 500's. All drive functions that can be performed at the drive keypad can also be performed with the Remote Panel. Speed, Start/Stop, and Direction commands can be broadcast simultaneously to all drives connected. Network initialization (configuration) is also performed by the Remote Panel. Additionally, the Remote Panel can be used to upload all drive parameters and store them in memory. They can then be downloaded to another drive. The remote panel controls the ACH 500 via the RS-485 Serial Communication Link. A 9.8 ft. (3 m) cable is included to connect to the first drive (maximum distance allowable with drive supplied power). Maximum length of the RS-485 cable is 3,937 feet (1200 m) if a separate (9 v ±1 v, 200mA) power supply is provided for the panel.

■ Hand-Off-Auto Switch & Speed Pot

Cover-mounted switch is prewired at the factory to allow the user to select one of three modes. In HAND, the drive will be started, and the speed will be controlled by the cover-mounted speed potentiometer. In OFF, the drive will be stopped. In AUTO, the drive will be started by a remote contact closure provided by the customer, and the speed will be controlled by a remote signal (voltage, current or pneumatic).



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DRIVE FEATURES - POWER

■ Three Current Limit Circuits and 225% O.C. Trip

The ACH 500's current limit circuitry and 225% (315% peak) overcurrent trip level, allows the ACH 500 to operate as a "tripless" drive. The three current limit circuits dynamically control motor current and prevent excessive motor current from unduly tripping the drive. The three current limit functions operate as follows:

1. Rapid Current Regulation.

The Rapid Current Regulation is adjustable from 50% to 170%. If the motor current exceeds the Current Limit setting, the ACH 500 will stop, and decrease the output frequency until the motor current is reduced below the current limit level, at which time the output frequency will accelerate (at the rate set by the acceleration time) to the set frequency. The Rapid Current Regulation allows up to 200% current to be drawn for a short period of time before the current is reduced to the Slow Current Regulation Limit.

- Slow Current Regulation.
 Adjustable from 50% to 125% of the ACH 500's rated current, this current regulation circuit operates similarly to the Rapid Current Regulation, except at a slower rate.
- 3. Current Switch-Off Limit. When the rapid current regulation limit is exceeded, and the Current Switch-Off Limit is reached (255% peak in ACH 501 and 315% peak in ACH 502) the output voltage to the motor is shut off momentarily. Every two to three milliseconds, the output voltage is switched back on to take control of the motor. If the current is not below the 150% level, voltage will again be switched off.

This function will operate 10 times to control the motor current prior to it either controlling the motor, or shutting down the drive on an overcurrent trip.

■ DC Line Reactor

A DC Line Reactor is standard equipment on the ACH 500. This added impedance to the DC link results in several improvements over Pulse Width Modulated (PWM) drives not so equipped. Displacement power factor is thus improved, and lower harmonic distortion on the power line is achieved without additional line inductors or transformers. For harmonic distortion calculations, please contact the factory.

■ IGBT Power Electronics

The ACH 500 uses the latest IGBT (Insulated Gate Bi-Polar Transistor) power switching devices. These fast response IGBT's allow "tripless" operation enabling 100% motor load capability at a motor's rated load. This minimizes the derating requirements of the motor. In addition, audible motor noise is significantly reduced, which means the ACH 500 can be used in applications where low noise levels are essential. Other significant advantages of this technology are:

- Minimal gate currents are achieved for the control of large motor currents. This minimizes the power of the gate circuits and allows lower power supply requirements; resulting in greater commonality of spare parts.
- The inherently fast switching rates of the ACH 500 result in smoother motor control when compared to switching rates below 1 kHz. In addition, they minimize the derating requirements of the AC motor at nominal speed while assuring reliable and safe shutdowns during fault conditions.
- Minimal switching losses of IGBT's result in better efficiency and allows for smaller enclosures.

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DRIVE FEATURES - PROTECTION

■ Power Line Protection

The ACH 500 has built-in fast acting semi-conductor input fuses as standard inside the standard.

Power line voltage surge protection is provided by means of a Metal Oxide Varistor (M.O.V.) across the DC bus or the AC line. This protects the diodes in the ACH 500's 3-phase full wave bridge.

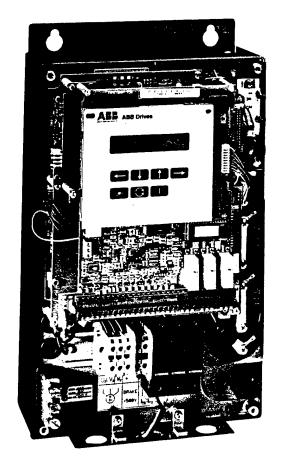
■ Integral Protection Circuits

The ACH 500 was designed to protect the drive and motor from the hazards of continuous service in the most demanding of applications. Built-in protection circuits include the following:

- Overcurrent trip limit 375% instantaneous
- Slow current regulation limit -150%
- · Rapid current regulation limit-200% adjustable
- Current switch-off limit-300% instantaneous
- Overvoltage trip limit -130%
- Undervoltage trip limit -65%
- · Over temperature protection YES
- Ground fault protection YES (see specifications)
- Microprocessor protection YES
- Motor stall protection YES
- Smart Motor overload protection (I²t) YES
- Single phasing on input in ACH 502 drives

■ NEMA 12, NEMA 1, Chassis Offerings

The ACH 500 is available in both NEMA 1 ventilated and NEMA 12 (dust tight) enclosures. These enclosures incorporate rugged die cast backs in wallhung units (up to 75 HP variable torque). ACH 500 drives can also be chassis mounted for OEM applications, or for inclusion in site-specific enclosures.





DRIVE FEATURES - CONTROL

■ Acceleration/Deceleration Rates

The ACH 500 provides two individually controlled, selectable sets of acceleration/deceleration rates from 0.1 to 1800 seconds.

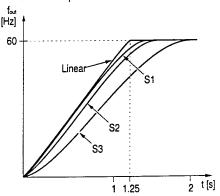
Min. theoretical time -120 Hz/0.1 seconds

Max. theoretical time - 120 Hz/1800 seconds

Switching between the two accel/decel rates may be controlled via a program designated digital input (Parameter 20.3.1).

· Linear or "S" Curve Ramping

The ACH 500 also offers selection of the shape of the acceleration/deceleration ramp curves; linear or 3 different S-curves. S-curve ramps are ideal for applications where a smooth transition is required when changing from one speed to another.



A Linear curve selection is suitable for drives requiring steady acceleration/deceleration and/ or slow ramps. Three "S" curves are also available:

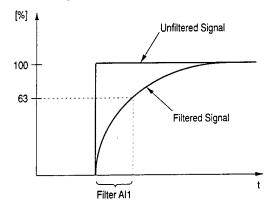
- S1 Shape-Suitable for ramp times <1 second.
- S2 Shape-Suitable for ramp times <1.5 seconds.
- S3 Shape-Suitable for ramp times up to 15 seconds.

Analog Inputs

The ACH 500 has two analog inputs as standard which are both capable of operating from 0-10 VDC or 0-20 mA, or from a potentiometer. Each of these analog inputs can then be altered by activating the following parameters:

Analog Input Filters

With this parameter, a time of between 0.01 to 10 seconds can be specified which will RC Filter the analog input signal. 63% of the change of the analog input takes place within the time period given by this parameter. (If the minimum value of 0.01 seconds is selected, the signal is not filtered.)



· Analog Input Min/Max Settings

The Analog Input Minimum setting operates as an input offset, allowing settings of 0V/0mA or 2V/4mA to be the input signal required to begin accelerating from minimum speed. An automatic offset adjustment allows the user to input the minimum analog input setting and scale the drive so it will not start to accelerate from zero speed until the offset input signal is exceeded.

The Analog Input Max setting is the analog input signal corresponding to the maximum signal that will be applied. This may be set such that 10V/20MA is the full speed, or an automatic gain setting may be used, such that the user inputs the maximum speed signal and it scales the drive output so that full speed is achieved at this point.

Analog Input Inversion

The analog input signal can be inverted so that the minimum analog input signal can correspond to the maximum reference and the maximum analog input signal can correspond to the minimum reference.

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DRIVE FEATURES - CONTROL (cont'd)

External References

The ACH 500 can be controlled from two external control locations, referred to as 'external references'. Each external reference can have a different Start/Stop and Speed Input, or they can be programmed to be the same signal. For example, you could have a start/stop push-button station as the start/stop for both references, and select between two different speed signals; or you could have one speed signal and select between a start/stop push-button station and the keypad start/stop.

The ACH 500 can accept a variety of speed references, such as:

Analog Reference

The ACH 500 speed reference can be supplied to one of the two analog inputs on the customer terminal strip.

Floating Point Control

The ACH 500 has a Floating Point input as a standard feature. By using two digital inputs for the speed reference, you can connect two drycontacts, such as a Dwyer Photohelic[®] gage, to the ACH 500. One contact, when closed, will cause the ACH 500 to increase speed; the other contact will cause the ACH 500 to decrease speed.

Keypad

The ACH 500 keypad can also be used for the external reference.

· Reference Scaling

The two external references can each be independently scaled, so that the minimum and maximum analog input can correspond to a frequency other than the minimum and maximum frequency. This is very useful, for example, if you want to apply the same 0 - 10 VDC reference to two or more drives, and want one drive to operate from 0 to 60 Hz and the other to operate from 0 to 53 Hz.

· Mathematical Functions

The ACH 500 can perform mathematical functions on the signals connected to the analog inputs. These functions are: Addition, Subtraction, Multiplication, Square root, Sum of the square roots, Minimum, and Maximum.

For example, if you select the multiplication function, the ACH 500 will multiply the signal on Analog Input 1 by the signal on Analog Input 2. That is, if Analog Input 1 was set to 50% speed, and Analog Input 2 was being

used to ratio the speed, then when Analog Input 2 is at zero, the output frequency would be zero. When Analog Output 2 is at 50%, the output frequency would be 25%, and when Analog Output 2 is at 100%, the output frequency would be 50%.

Analog Outputs

Analog output signals are 0(4) to 20mA and can be proportional to output frequency, motor speed, output current, motor torque, motor power, DC Bus voltage, motor voltage, or the active reference. These signals can be scaled (10 to 1 Gain) so that small or large changes in the parameter can represent full scale.

Auto Restarts

The ACH 500 Drive can automatically restart after a fault by selecting the following parameters:

- Number of Trials 0 to 5 restart attempts can be specified.
- Trial Time 1 to 180 seconds can be specified.
 This defines the period of time that the ACH
 500 may experience the programmed number
 of restarts and remain on line. If the application
 causes the ACH 500 to trip more than the
 number of trials set within the programmed trial
 time, the ACH 500 will stop operating and
 display the fault on its display screen.
- Time between reset attempts can be programmed from 0 to 120 seconds. The time until reset occurs counts down on the display.
- Overvoltage, Undervoltage, Overcurrent and Analog Input <2V/4mA can be selected.
 Normal operation is restored after the fault condition has been corrected. However, if the fault is not cleared, the drive stops.

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DRIVE FEATURES - CONTROL (cont'd)

Carrier Frequency

By utilizing IGBT's, the ACH 500 drive employs high switching frequencies, so the motor current is practically sinusoidal. Audible motor noise can also be minimized by choosing a switching frequency up to 12kHz in the ACH 501. These frequencies can be adjusted or changed to best fit the application. When raising the switching frequency above 3 kHz, the switching losses in the drive will increase. Derating may be necessary, depending on the application.

■ Critical Frequency Lockouts

For applications where it may be necessary to avoid specific frequencies due to mechanical resonance problems in the driven equipment, the ACH 500, with its Critical Frequency Lockout Function, makes it possible to set-up five different frequency ranges which will be avoided during operation of the drive.

Each critical frequency setting allows the user to set low and high critical frequency limits. If the speed reference signal requires the ACH 500 to operate within this critical frequency range, the critical frequency lockout function will keep the ACH 500 operating at the low (or high) limit until the reference is out of the critical frequency range, at which time the output frequency will ramp through the critical frequency range at the set accel or decel ramp.

Extended Power Loss Ride-through

The ACH 500 is equipped with an automatic extended power loss ride-through circuit.

This circuit utilizes the inertia of the load to keep the drive powered. The minimum power loss ride-through is one-cycle (16.6 milliseconds), based on full load and no inertia. However, because inertia of the load generates power to the drive, the ACH 500's power loss ride-through capability can be extended well beyond one cycle, depending on the load inertia.

■ Input Power

One of the more unique features of the ACH 500 is its ability to operate from wide range of input power potentials.

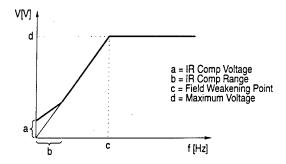
Most U.S. based power systems operate at 480 VAC +10% and many AC drives are rated for only 460 VAC + 10%. This results in a maximum operational voltage from 506 VAC to 528 VAC where the utility is within specifications, but above most drives' capabilities. The ACH 500's flexibility allows for operation at 500 VAC + 10% (i.e. 550 VAC maximum). Benefit - ability to operate on high lines without nuisance overvoltage trips.

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■ IR Compensation

A complete set of parameters is included in the ACH 500 which allows for extra torque to be applied at speeds between 0.1 Hz and the set field weakening point (Programmable Range). The following settings are available:

- NO
- MANUAL
- AUTOMATIC



This provides for higher voltage at low speeds anytime during operation (not just at initial start-up; i.e. start function with torque boost). In Automatic, the IR Compensation voltage is set automatically as a function of effective motor current. In Manual, both the IR-Comp Voltage and IR-Comp Range are adjustable.

Overvoltage Limit

High DC Bus voltage (caused by overhauling loads) will cause frequency to increase instead of causing the drive to trip Overvoltage. The voltage limit circuits can be disabled for applications where a change in speed is not allowed.

■ Parameter Lock

Prevents unauthorized persons from altering the parameters of the ACH 500 by providing a programmable combination number. To open the Parameter Lock, the correct combination must be entered. The parameter lock can also be set to a digital input.

■ Preset Speeds

The ACH 500 allows for seven (7) programmable preset speeds to be selected from the digital inputs. This capability is valuable in a wide range of HVAC applications. One of the seven preset speeds is also used as a fault speed in case of an internal serial communication fault or loss of analog input signal.



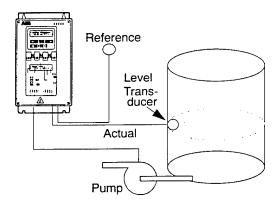
DRIVE FEATURES - CONTROL (cont'd)

■ Proportional Integral (PI) Setpoint Controller

An integral PI Controller with twelve (12) programmable parameters is standard in the ACH 500. These can then be configured to control speed, pressure, flow, fluid level, or other process parameters for maximum efficiency and optimum building control.

The PI controller allows the ACH 500 to maintain a certain process variable - such as flow or pressure - by constantly adjusting the output frequency. Instead of applying a speed reference to the ACH 500, a Process Reference (Setpoint) is applied. An Actual Signal (Feedback) is brought back to the ACH 500.

The ACH 500 compares the two signals, and adjusts the output frequency up or down to cause the difference between the Reference and Actual signals to be as small as possible.



■ Pump & Fan Control

Pump & Fan control is similar to the PI-control above, with the added ability to sequence additional pumps on/off to keep up with the system demand; this feature can eliminate the need for a PLC or pump sequencer.

■ Resolution - 0.01 Hz Frequency

Since the ACH 500 uses digital technology, the output frequency can be adjusted from 0 to 120 Hz in 0.01 Hz increments.

■ Slip Compensation

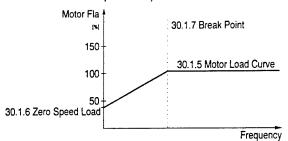
This parameter in the ACH 500 acts to minimize motor slip under varying loads. For example, a squirrel-cage motor will slip under load. This slip can be compensated for by increasing the frequency as the current increases. By activating this parameter, the slip will be automatically reduced down to within approximately 10% or better of the original value.

■ Smart Motor Overload

The "smart" motor overload feature of the ACH 500 is designed to take into account the thermal characteristics of the AC motor. When this function is activated, it may be set to provide a warning (indication on display or digital output changing states) or a fault (same as warning, but drive stops).

This flexible function allows the ACH 500 to calculate motor thermal rise based on the time of an overload, the output frequency, and the current drawn by the motor from the drive. This motor temperature rise is calculated using the following assumptions:

- 104 F (40 C) is the ambient motor operating temperature.
- The motor is at ambient when power is applied.
- The motor cooling time is four times greater when stopped than when running
- At low speeds, the cooling capability of the motor is drastically reduced when a fan driven by the motor shaft is used. The rate of heating and cooling is based on the motor's thermal time constant (default settings for typical motors are provided).



The operation curve can be completely customized to protect motors within any rated speed range.

Stall Protection

The ACH 500 provides protection against a stalled motor. When activated, this function can provide a warning or a fault condition caused by excessive motor current at low speeds. The stall current limit can be adjusted from 0 to 1.5 times the ACH 500's $\rm I_N$ rating. The stall frequency/time is also adjustable.

■ Start/Stop Functions

Various Start/Stop control alternatives are accommodated by the design of the ACH 500, all aimed at increasing efficiency of operation and ease of customization for specific applications.

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DRIVE FEATURES - CONTROL (cont'd)

Motor starting torque of 180% of the rated torque can be achieved by selecting Start with torque boost. This avoids oversizing the drive and guarantees reliable starting of even the heaviest loads. (Note - The ACH 500 is designed to operate NEMA design B motors with a ratio of breakdown torque to rated torque of 2.6 to 2.9.)

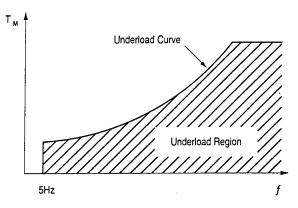
■ Flying Start

The Flying Start function allows the ACH 500 to match its output frequency to the rotational speed of a rotating motor. The ACH 500 is able to smoothly resume operation without forcing the motor to zero speed before accelerating.

■ Underload Function

The ACH 500 offers choices for five (5) Underload Curves and an Underload Time. By selecting the proper torque, frequency, and time parameters, the built-in protection function will then be activated if:

- The motor torque drops below the selected load curve
- The condition has lasted longer than the selected time
- The output frequency is more than the 5Hz.
 This feature is useful to indicate when a pump goes dry, or a belt breaks.

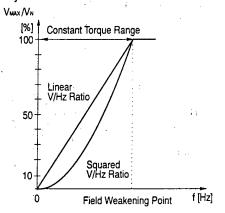


■ V/Hz (volts per hertz) Shape Control

This parameter allows for the setting of the voltage to frequency relationship in the region below the Field Weakening Point. Three settings are available which are intended to minimize noise, motor losses, and to maximize efficiency:

 Linear - The voltage of the motor changes linearly with frequency.

- Squared The voltage of the motor varies as the square of the frequency applied by the drive, to the AC motor. Squared V/Hz is normally used in applications where the load torque characteristics are proportional to the square of the speed, such as centrifugal pumps, fans and compressor drives (variable torque). (Appropriate for single motor applications). Considering the energy saving nature of this function, it is appropriate in lightly loaded applications.
- Automatic The motor voltage is automatically controlled to minimize motor current. This setting is suitable for a single motor constant torque drive system with slow changes in system load.



■ Supervisions

The supervision functions are a unique feature of the ACH 500 which allow the drive to monitor the frequency, reference or current, and give an indication if the value of that parameter goes above or below a value which is programmed by the user.

Two frequency limits, one current, and two reference limits can be monitored, and all can be set to indicate either a high limit or low limit. The supervision message will appear on the display, and can also be output through the relay outputs.

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OPTIONAL FEATURES

■ 3 to 15 PSI Speed Input

Option board with pressure to electrical transducer to accept a 3 to 15 PSI pneumatic signal as a speed reference for the ACH 500. Also included on this board are two isolators for the digital inputs, allowing them to accept a voltage (24 to 250 VAC or VDC) to activate a digital input, such as 115 VAC start signal.

■ OPTION PACK

The Option Pack is the extended enclosure added to ACH 501 units to house the elecro-mechanical options listed below.

The following options require the extended enclosure in ACH 501 units. (See dimension drawing labeled ACH 501 w/Option Pack).

The enclosure rating is determined by the rating that you select from the price table (NEMA 1 or NEMA 12 only).

■ CONTROL

115 VAC Control Transformer & Terminal Board. Terminal Board for convenient connection of all field control wiring, including all drive inputs and outputs. Includes 115 VAC Start input. Control voltage for start and safety interlocks is 115 VAC.

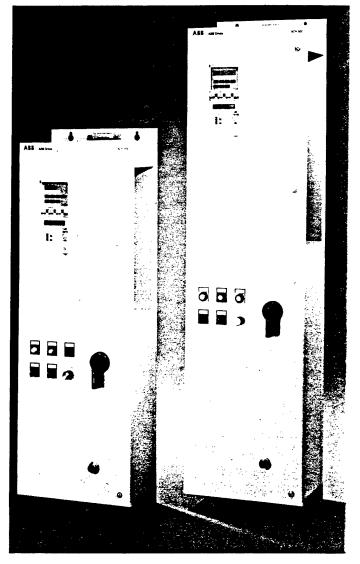
Also includes 150 VA control transformer, and terminals for field use (approximately 100 VA available).

■ INPUT OPTIONS

Circuit Breaker. Thermal Magnetic Circuit Breaker, thru-the-door interlock type, pad-lockable in the OFF position. (If two MOL's are supplied, the circuit breaker will be a Magnetic Trip Motor Circuit Protector (MCP)). The circuit breaker option is required with bypass in ACH 502 units.

Disconnect Switch. Non-fused disconnect switch, thru-the-door interlock type, pad-lockable in the OFF position. When bypass is supplied (on ACH 501), fuses are supplied with the disconnect switch to provide branch circuit protection for the motor in bypass.

Line Reactor. 3% and 5% impedance line reactors are available to limit the harmonics back to the power line. Reactors are mounted in the option pack on R2 through R5 units, and in the standard enclosure on R6 through R9 units (R8 unit with line reactor will be supplied in the two bay enclosure).



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OPTIONAL FEATURES - (cont'd)

BYPASS OPTIONS

Manual Bypass. Allows motor to be connected to line power and operate at full speed instead of being powered by the drive. In bypass, the start signals and safety interlocks are still active. Switching to bypass automatically disables the drive.

Motor Overload option may be required to meet local codes.

Control Option B with 115 VAC control transformer is required with all bypass options.

The circuit breaker option is required with bypass in ACH 502 units.

The bypass option includes Normal and Bypass Pilot Lights, and an external fault circuit with an indicating lamp which illuminates when any external safety device has shut down the motor. All pilot lights are push-to-test type.

Manual Bypass With Service Switch. Bypass option as described above with an additional switch which allows power to be removed from the drive for servicing, while the motor operates from line power. Switch is mounted internally to prevent unauthorized persons from disrupting operation.

When bypass is selected, power is removed from the

Automatic Bypass. Automatically transfers motor to line power after the drive trips out on a protective trip. If automatic restart has been enabled on the drive, the drive will attempt to automatically restart before the motor is transferred to line power. (Requires Manual Bypass option).

■ THERMAL OVERLOAD RELAYS:

Motor Overload Relay (MOL). Standard, manually resettable, bimetallic, motor overload relay with Class 20 trip curve provides thermal motor protection when operating from the drive, and across the line with Bypass option. Thru-the-door reset button is included. NOTE: MOL must be sized to the drive for UL Listing.

If two MOL's are required, the Circuit Breaker option must be ordered, and Class 10 adjustable overloads will be supplied. The overload will be sized such that the current rating selected is within the range of adjustment of the overload.

Analog Meters

Up to four analog meters can be installed in the extended enclosure. The meters available are: output ammeter (one or two, depending on the number of motors to be driven), output voltmeter, output speedmeter calibrated in % of maximum speed. (Note: one analog output of the drive is used when speed meter supplied).



TECHNICAL DATA

■ Control Connections

The ACH 500 drive can be controlled from its digital control panel or from external control devices. External control devices are connected to either Terminal Block X50 or TB1.

In ACH 501 standard units, connections are made to X50. In ACH 501 units with optional extended enclosure, connections are made to TB1. In ACH 502 units, connections are made to TB1.

All parameters are set from the control panel. The following figures show input and output signals of the Control Interface Card and their Connections to the Terminal Block X50 and TB1.

Terr	ninal X50	Function	Factory Settings	Remarks
1	REF	Reference voltage 10 V DC, max 10mA		
2	GND 2	Potentiometer 1KΩ≤ R ≤10KΩ		
3	Al 1+	Analog Input 0 - 10 VDC R=200kW (max)	REFERENCE (AUTO)	10 Bit Resolution
4	Al 1-	0 - 20 mA R=250W (min)	, , , , , , , , , , , , , , , , , , , ,	* .
5	Al 2+	Analog Input 0 - 10 VDC R=200kW (max)	REFERENCE (HAND)	12 Bit Resolution
6	Al 2-	0 - 20 mA R=250W (min)	,	
7	SPL	Auxiliary voltage output 24 V DC		For field use
8	GND 2	200mA max		
9	N.C.	Not connected		
10	SPL	+24 V max. 10 mA		For Digital Inputs
11	DI 1		START HAND	6 Digital Inputs
12	DI 2		AUTO SELECT	Programmable
13	DI 3		PRESET SPEED SEL	via Keypad
14	D! 4		PRESET SPEED SEL	via neypau
15	DI 5		RUN ENABLE	
16	DI 6		START AUTO	
17	AO 1+	Analog Output 0 - 20 mA	Output Frequency	2 Analog Outputs
18	AO 1-	\$	_	maximum load 500Ω
19	AO 2+	Analog Output 0 - 20 mA	Output Current	00032
20	AO 2-			
21	RO 11	Relay Output 1		
22	RO 12		READY	3 Form C Relays
23	RO 13	_	<u> </u>	max. switching voltage 300 VDC/250 VAC
24	RO 21	Relay Output 2	-	max. switching current 8 A/24 VDC; 0.4 A/250 VDC
25	RO 22	neiay Output 2	RUN	8 A/24 VDC; 0.4 A/250 VDC
26	RO 23			max. switching power 2000 VA/250 VAC
	DO OL]	max. continuous current
27	RO 31	Relay Output 3		2A
28	RO 32		FAULT	†
29	RO 33	_		

Terminal X51

1	+8V	Power to remote panel
2	GND2	· ·
3	Shield1	RS-485 Serial Link Connections
4	GND3	
5	SGNA	
6	SGNB	
7	Shield2	

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PARAMETER LISTING

Parameter	Alternative Settings	Custom Setting
START-UP DATA		<u> </u>
A LANGUAGE	ENGLISH; GERMAN; ITALIAN; SPANISH; DUTCH; FRENCH; DANISH; FINNISH; SWEDISH	
B APPLICATIONS	HVAC; FLOAT PT; HVAC-PI P&F AUTOM; USER load; USER save	
C APPLIC. RESTORE	NO; YES	
D SUPPLY VOLTAGE	208/220/230/240; 380/400/415; 440/460/480/500	ļ
E USER DISPLAY SCALE	0 – 10000	
F MOTOR CURRENT -FLA	0 A - 1000 A (printed on the motor nameplate)	
G MOTOR POWER hp (kW)	0.7 hp - 1340 hp (0.5 kW - 1000 kW) (printed on the motor nameplate)	
H MOTOR POWER FACTOR	0.1 – 1.0 (printed on the motor nameplate)	
I MOTOR BASE FREQ.	30 Hz – 500 Hz (printed on the motor nameplate)	
J MOTOR BASE R.P.M.	200 RPM – SYNC. SPEED (printed on the motor nameplate)	<u> </u>
K MOTOR NOM. VOLTAGE	110 V - 575 V (printed on the motor nameplate)	
OPERATING DATA		
1 OUTPUT FREQUENCY	Hz	
2 SPEED	RPM; %; USER SCALING	
3 MOTOR CURRENT	A	1
4 % RATED TORQUE	%	+
5 % RATED POWER	%	
6 DC BUS VOLTAGE	V; % OF RATED NOMINAL	
7 OUTPUT VOLTAGE	V	
8 DRIVE TEMPERATURE	degrees C and F	
9 CONTROL LOCATION	KEYPAD R1; KEYPAD PI; EXTERNAL	
10 KEYPAD REF 1	Hz	
11 KEYPAD PI (REF 2)	%	
12 EXT REF 1 OR 2	REF1/REF2	
13 EXTERNAL REF 1	Hz	
14 EXTERNAL REF 2	%	
15 RUN TIME	h/min	
16 KILOWATT HOURS	kWh	
17 LAST-RECD FAULT	FAULT; WARNING	
18 SECOND-RECD FAULT	FAULT; WARNING	
19 FIRST-RECD FAULT	FAULT: WARNING	<u> </u>
20 PARAMETER LOCK	OPEN xxx; LOCKED xxx; OPEN; LOCKED	
21 APPL BLOCK OUTPUT	%	
	%	
22 ACTUAL VALUE 1	%	
23 ACTUAL VALUE 2 24 AUX MOTORS RUNNING	0-3	
24 AUX MOTORS RUNNING	%	
25 CONTROLLER OUTPUT	% %	
26 CONTROL ERROR	Engineering Units	
27 ACT VALUE 1 (PFC)	Engineering Units	
28 ACT VALUE 2 (PFC)	Engineering Office	
10 CONTROL CONNECTIONS		
10.1 START/STOP/DIRECTION	NOT SEL; DI1; DI1,2; DI1P,2P; DI 1P, 2P, 3; DI1P,2P,3P; DI6; DI6,5; KEYPAD	
10.1.1 EXT 1 STRT/STP/DIR	NOT SEL; DIG, DIG, S; DI1; DI1,2; DI1P,2P; DI 1P, 2P, 3; DI1P,2P,3P; KEYPAD	
10.1.2 EXT 2 STRT/STP/DIR	REVERSE; FORWARD; REQUEST; FAST REV	1 -
10.1.3 LOC/EXT DIRECTION	MEVEROE, FURWARD, REGULOT, I AOT TIEV	1
10.2 EX REFERENCE SELECT	DATA 40. DIA. DIO. DIA. DIS. DIS.	
10.2.1EXT 1/EXT 2 SELECT	OP DATA 12; DI1; DI2; DI3; DI4; DI5; DI6	
10.2.2 EXTERNAL REF1 SEL	OP DATA 13; Al1; Al2; Al1/JOYST; DI3U,4D; DI3U,4D(R); DI5U,6D	
10.2.3 EXT REF1 MINIMUM	0 Hz - 500 Hz (ACH 501); 0 Hz - 120 Hz (ACH 502)	
10.2.4 EXT REF1 MAXIMUM	0 Hz - 500 Hz (ACH 501); 0 Hz - 120 Hz (ACH 502)	
10.2.5 EXTERNAL REF2 SEL	OP DATA 14; Al1; Al2; DI3U,4D; DI3U,4D(R); DI5U,6D	
10.2.6 EXT REF2 MINIMUM	0 Hz - 500 Hz (ACH 501); 0 Hz - 120 Hz (ACH 502)	
10.2.7 EXT REF2 MAXIMUM	0 Hz - 500 Hz (ACH 501); 0 Hz - 120 Hz (ACH 502)	

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Parameter	Alternative Settings	Custom Setting
10.3 PRESET SPEEDS		
10.3.1 PRESET SPEED SEL	NOT SEL; DI1 – DI6; DI1,2; DI3,4; DI5, 6; DI1,2,3; DI3,4,5; DI4,5,6	
10.3.2 PRESET SPEED 1	0 Hz - 500 Hz (ACH 501); 0 Hz - 120 Hz (ACH 502)	
10.3.3 PRESET SPEED 2	0 Hz - 500 Hz (ACH 501); 0 Hz - 120 Hz (ACH 502)	
10.3.4 PRESET SPEED 3	0 Hz - 500 Hz (ACH 501); 0 Hz - 120 Hz (ACH 502)	
10.3.5 PRESET SPEED 4	0 Hz - 500 Hz (ACH 501); 0 Hz - 120 Hz (ACH 502)	
10.3.6 PRESET SPEED 5	0 Hz - 500 Hz (ACH 501); 0 Hz - 120 Hz (ACH 502)	
10.3.7 PRESET SPEED 6	0 Hz - 500 Hz (ACH 501); 0 Hz - 120 Hz (ACH 502)	
10.3.8 PRESET SPEED 7	0 Hz - 500 Hz (ACH 501); 0 Hz - 120 Hz (ACH 502)	
10.4 SYSTEM CONTR INPUTS		1
10.4.1 RUN ENABLE	YES; DI1; DI2; DI3; DI4; DI5; DI6	
10.4.2 FAULT RESET SELECT	NOT SEL; DI1; DI2; DI3; DI4; DI5; DI6; ON STOP	
10.4.3 PARAM, LOCK SEL	OP DATA 20; DI1; DI2; DI3; DI4; DI5; DI6	
10.4.4 EXTERNAL FAULT	NOT SEL; DI1; DI2; DI3; DI4; DI5; DI6	
10.5 ANALOG INPUTS		
10.5.1 MINIMUM AI1	0 V/0 mA; 2 V/4 mA; READ INPUT	
10.5.2 MAXIMUM AI1	10 V/20 mA; READ INPUT	
	0.1s - 10s	
10.5.3 RC FILTER ON AI1	<u> </u>	
10.5.4 INVERTAI1	NO; YES	
10.5.5 MINIMUM AI2	0 V/0 mA; 2 V/4 mA; READ INPUT	
10.5.6 MAXIMUM AI2	10 V/20 mA; READ INPUT	
10.5.7 RC FILTER ON AI2	0.1s - 10s	
10.5.8 INVERT AI2	NO; YES	<u> </u>
10.6 RELAY OUTPUTS		<u> </u>
10.6.1 RELAY RO1 OUTPUT	NOT USED; READY; RUN; FAULT; FAULT(-1); FAULT(RST)	
10.6.2 RELAY RO2 OUTPUT	STALL FLT; MOT OT FLT; OT FAULT; FAULT/WARN; WARNING	
10.6.3 RELAY RO3 OUTPUT	OT WARNING; REVERSED; EXT. CTRL; REF 2 SEL; PRESET SPD; DC BUS LIM; FREQ 1 LIM; FREQ 2 LIM; CURR LIMIT; REF 1 LIMIT; REF 2 LIMIT; AT SPEED; (P&F AUTOM)	
10.7 ANALOG OUTPUTS	**************************************	
10.7.1 ANALOG OUTPUT 1	NOT USED; OUT FREQ; MOT SPEED; OUT CURR; MOT TORQ; MOT POWER; V/DC BUS; MOTOR VOLT; REFERENCE; ERROR VAL; PICON OUTP; ACTUAL 1; ACTUAL 2; PICON REF	
10.7.2 SCALE AO1	10% - 1000%	
10.7.3 MINIMUM AO1	0 mA; 4mA	
10.7.4 RC FILTER ON AO1	0.01s - 10s	
10.7.5 INVERT AO1	NO; YES	
10.7.6 ANALOG OUTPUT 2	NOT USED; OUT FREQ; MOT SPEED; OUT CURR; MOT TORQ; MOT POWER; V/DC BUS; MOTOR VOLT; REFERENCE; ERROR VAL; PICON OUTP; ACTUAL 1; ACTUAL 2; PICON REF	
10.7.7 SCALE AO2	10% 1000%	
10.7.8 MINIMUM AO2	0 mA; 4 mA	
10.7.9 RC FILTER ON AO2	0.01s - 10s	
10.7.10 INVERT AO2	NO; YES	
20 DRIVE PARAMETERS		
20.1 FREQ/CURRENT LIMITS		
20.1.1 MINIMUM FREQUENCY	0 Hz – MAX. FREQ.	
20.1.2 MAXIMUM FREQUENCY	0 Hz - 500 Hz (ACH 501); 0 Hz - 120 Hz (ACH 502)	
20.1.3 FREQUENCY RANGE	0 Hz - 120 Hz; 0 Hz - 500 Hz (ACH 501 only)	
20.1.4 CURRENT LIMIT	0.5 – 2.0 x I _N (ACH 500)	
20.2 START/STOP	, N V	
20.2.1 START FUNCTION	RAMP; FLYING; TORQ BOOST; FLYING+TQB	
20.2.2 TORQUE BOOST CURR	0.5 – 2.0 x I _N (ACH 500)	
20.2.3 STOP FUNCTION	COAST; RAMP; DC BRAKE	
20.2.4 BRAKE CHOPPER	NO; YES	
20.2.5 DC HOLD	OFF; ON	
20.2.6 DC HOLD VOLTAGE	0.01 - 0.1 x V _N	
20.2.7 DC BRAKE VOLTAGE	0.01 – 0.1 x V _N	
20.2.8 DC BRAKE TIME	0s – 250s	
20.3 ACCEL/DECEL		
20.3.1 ACC/DEC 1 0R 2 SEL	NOT SEL; DI1; DI2; DI3; DI4; DI5; DI6	
20.3.2 ACC/DEC RAMP SHAPE	LINEAR; S1; S2; S3	

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Parameter	Alternative Settings	Custom Setting
20.3.3 ACCEL TIME 1	0.1s - 1800s	
20.3.4 DECEL TIME 1	0.1s - 1800s	
20.3.5 ACCEL TIME 2	0.1s - 1800s	
20.3.6 DECEL TIME 2	0.1s - 1800s	
20.3.7 ACCEL REF2 TIME	0.1s - 1800s	
20.3.8 DECEL REF2 TIME	0.1s - 1800s	
20.4 MOTOR CONTROL	10 11 (40 U 504) 0 0 H I - (40 U 502)	
20.4.1 SWITCHING FREQ	1.0 kHz - 12.0 kHz (ACH 501); 3.0 kHz (ACH 502)	
20.4.2 MAX OUTPUT VOLTAGE	0.15 - 1.05 x V _N	
20.4.3 V/HZ RATIO	LINEAR; SQUARED; AUTOMATIC	
20.4.4 FIELD WEAK POINT	30 Hz – 500 Hz NO; MANUAL; AUTOMATIC	
20.4.5 IR COMPENSATION		
20.4.6 IR COMP VOLTAGE	0.01 – 0.15 x V _N	
20.4.7 IR COMP RANGE	0 Hz – FWP	
20.4.8 SLIP COMPENSATION	OFF; ON	
20.4.9 NOMINAL SLIP		
20.4.10 VOLTAGE LIMIT	OFF; ON	
20.5 CRITICAL FREQUENCIES	OFF: ON	
20.5.1 CRIT FREQ SELECT	0 Hz – 500 Hz (ACH 501); 0 Hz – 120 Hz (ACH 502)	
20.5.2 CRIT FREQ 1 LOW 20.5.3 CRIT FREQ 1 HIGH	0 Hz - 500 Hz (ACH 501); 0 Hz - 120 Hz (ACH 502)	
20.5.4 CRIT FREQ 1 HIGH 20.5.4 CRIT FREQ 2 LOW	0 Hz - 500 Hz (ACH 501); 0 Hz - 120 Hz (ACH 502)	
20.5.5 CRIT FREQ 2 HIGH	0 Hz - 500 Hz (ACH 501); 0 Hz - 120 Hz (ACH 502)	
20.5.6 CRIT FREQ 2 FIGHT	0 Hz - 500 Hz (ACH 501); 0 Hz - 120 Hz (ACH 502)	
20.5.7 CRIT FREQ 3 HIGH	0 Hz = 500 Hz (ACH 501): 0 Hz = 120 Hz (ACH 502)	
20.5.8 CRIT FREQ 4 LOW	0 Hz - 500 Hz (ACH 501); 0 Hz - 120 Hz (ACH 502)	
20.5.9 CRIT FREQ 4 HIGH	0 Hz - 500 Hz (ACH 501); 0 Hz - 120 Hz (ACH 502)	
20.5.10 CRIT FREQ 5 LOW	0 Hz = 500 Hz (ACH 501); 0 Hz = 120 Hz (ACH 502)	
20.5.11 CRIT FREQ 5 HIGH	0 Hz - 500 Hz (ACH 501); 0 Hz - 120 Hz (ACH 502)	
30 PROTECTION/INFORMAT		
30.1 FAULT FUNCTION		
30.1.1 SERIAL FAULT FUNC	STOP; PRE SPEED7	
30.1.2 AI <min function<="" td=""><td>NO; WARNING; FAULT; PRE SPEED7</td><td></td></min>	NO; WARNING; FAULT; PRE SPEED7	
30.1.3 MOT TEMP FLT FUNC	NO; WARNING, FAULT	
30.1.4 MOTOR THERM TIME	300s - 10000s	
30.1.5 MOTOR LOAD CURVE	50% - 150%	
30.1.6 ZERO SPEED LOAD	40% - MOTOR LOAD CURVE	
30.1.7 BREAK POINT	1 Hz - 500 Hz	
30.1.8 STALL FUNCTION	NO; WARNING; FAULT	
30.1.9 STALL CURRENT	0 – 1.5 x I _N	
30.1.10 STALL TIME/FREQ	10s/15 Hz; 20s/25 Hz; 30s/35 Hz NO; WARNING FAULT	
30.1.11 UNDERLOAD FUNC	0 – 600s	
30.1.12 UNDERLOAD TIME		
30.1.13 UNDERLOAD CURVE	1-5	
30.2 AUTOMATIC RESET	0-5	
30.2.1 NUMBER OF RESETS	1s - 180s	
30.2.2 TIME WINDOW		
30.2.3 TIME BETW. RESET	0s – 120s	
ATTEMPTS	NO; YES	
30.2.4 OVERVOLTAGE	NO; YES	
30.2.5 UNDERVOLTAGE	NO; YES	
30.2.6 OVERCURRENT 30.2.7 AI SIGNAL <min< td=""><td>NO; YES</td><td></td></min<>	NO; YES	
30.2.7 AI SIGNAL CIVIIV		
30.3.1 OUTPUT FREQ 1 FUNC	NO; LOW LIMIT; HIGH LIMIT	
30.3.2 OUTPUT FREQ 1 LIM	0 Hz - 500 Hz (ACH 501); 0 Hz - 120 Hz (ACH 502)	
30.3.3 OUTPUT FREQ 2 FUNC	NO: LOW LIMIT: HIGH LIMIT	
30.3.4 OUTPUT FREQ 2 LIM	0 Hz - 500 Hz (ACH 501); 0 Hz - 120 Hz (ACH 502)	
30.3.5 CURRENT FUNCTION	NO: LOW LIMIT; HIGH LIMIT	
30.3.6 CURRENT LIMIT	0 - 2 x I _N (ACH 500)	
30.3.7 REF1 FUNCTION	I NO: LOW LIMIT: HIGH LIMIT	
30.3.8 REF1 LIMIT	0 Hz - 500 Hz (ACH 501); 0 Hz - 120 Hz (ACH 502)	
00.0.0 TIET TENTAL		

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Parameter	Alternative Settings	Custom Setting
30.3.9 REF2 FUNCTION	NO; LOW LIMIT; HIGH LIMIT	
30.3.10 REF2 LIMIT	0% 100%	
30.3.11 SUPERVIS MESSAGES	OFF; ON	
30.4 INFORMATION		
30.4.11 CRI PROG VERSION	(Version in Drive)	
30.4.2 MC PROG VERSION	(Version in Drive)	
30.4.3 TEST DATE	(Date Tested)	
40 APPLICATION PARAMETERS	(CAN BE SEEN ONLY WITH APPLICATION MACROS)	
40.1 PI-CONTROL	(CAN BE SEEN ONLY WITH PI-CONTROL MACRO)	
40.1.1 PI-CONT GAIN	3% - 800%	
40.1.2 PI-CONT I-TIME	0.02s - 320s	
40.1.3 PI-CONT MIN LIMIT	0 Hz - PI-CONT MAX LIMIT	
40.1.4 PI-CONT MAX LIMIT	0 Hz - 500 Hz (ACH 501); 0 Hz - 120 Hz (ACH 502)	
40.1.5 ERROR VALUE INVERT	NO; YES	
40.1.6 ACTUAL VALUE SEL	ACT1; ACT1-ACT2; ACT1+ACT2; ACT1*ACT2	
40.1.7 ACTUAL 1 INPUT	Al1; Al2	1
40.1.8 ACTUAL 2 INPUT	Al1; Al2	
40.1.9 ACT 1 MIN SCALE	-1600.0% - 1600.0%	
40.1.10 ACT 1 MAX SCALE	-1600.0% - 1600.0%	
	-1600.0% = 1600.0%	
40.1.11 ACT 2 MIN SCALE	-1600.0% - 1600.0% -1600.0% - 1600.0%	
40.1.12 ACT 2 MAX SCALE	(CAN BE SEEN ONLY WITH P&F AUTOM MACRO)	
40.2 PUMP & FAN CONTROL		
40.2.1 PI-CONT GAIN	3% – 800%	
40.2.2 PI-CONT I-TIME	0.1s - 320s	
40.2.3 REFERENCE STEP 1	0% – 100%	
40.2.4 REFERENCE STEP 2	0% – 100%	
40.2.5 REFERENCE STEP 3	0% – 100%	
40.2.6 SLEEP DELAY	0s - 3600s	
40.2.7 SLEEP LEVEL	0 Hz - 500 Hz (ACH 501); 0 Hz - 120 Hz (ACH 502)	
40.2.8 WAKE UP LEVEL	0% - 100%	
40.2.9 START FREQ 1	0 Hz - 500 Hz (ACH 501); 0 Hz - 120 Hz (ACH 502)	
40.2.10 START FREQ 2	0 Hz - 500 Hz (ACH 501); 0 Hz - 120 Hz (ACH 502)	
40.2.11 START FREQ 3	0 Hz - 500 Hz (ACH 501); 0 Hz - 120 Hz (ACH 502)	
40.2.12 LOW FREQ 1	0 Hz - 500 Hz (ACH 501); 0 Hz - 120 Hz (ACH 502)	
40.2.13 LOW FREQ 2	0 Hz - 500 Hz (ACH 501); 0 Hz - 120 Hz (ACH 502)	
40.2.14 LOW FREQ 3	0 Hz - 500 Hz (ACH 501); 0 Hz - 120 Hz (ACH 502)	
40.2.15 LAG MOT START DLY	0s – 3600s	
40.2.16 LAG MOT STOP DLY	0s - 3600s	
40.2.17 NBR OF LAG MOTORS	0-3	
40.2.18 ALTERNATION INTERV	0h – 168h	
40.2.19 ALTERNATION LEVEL	0% – 100%	
40.2.20 INTERLOCKS	OFF; ON	
40.2.21 ERROR VALUE INV	NO; YES	
40.2.22 ACTUAL 1 INPUT	NO; Al1; Al2	
40.2.23 ACTUAL 2 INPUT	NO; Al1; Al2	
40.2.24 ACTUAL VALUE SEL	ACT1; ACT1-ACT2; ACT1+ACT2; ACT1*ACT2; min(A1,A2); max(A1,A2); sqrt(ACT1); sqA1+sqA2	
40.2.25 ACT 1 MIN SCALE	-1600.0% - 1600.0%	
40.2.26 ACT 1 MAX SCALE	-1600.0% - 1600.0%	
40.2.27 ACT 2 MIN SCALE	-1600.0% - 1600.0%	
40.2.28 ACT 2 MAX SCALE	-1600.0% - 1600.0%	
40.2.29 REGUL BYPASS	OFF; ON	
40.2.30 DISPLAY UNIT	NO UNIT: bar; %; m/s; C; Pa; 1/min; m³/min; gpm;psi	
40.2.30 DISPLAY UNIT	0 – 50000	
	0-50000	
40.2.32 NBR OF DECIMALS	10-3	

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ORDERING INFORMATION

ACH 501 - 003- 4 - 0 0 P 2 Construction 1 = Sizes 002 to 075, Wall Mounted 2 = Sizes 060 to 400, Std Floor Stand Cabinet 4 = Sizes 060 to 400, Module Output Power (HP, Constant Torque) -Input Voltage -2 = 208-240 VAC 3 = 380-415 VAC 4 = 440-500 VAC Internal Option 2 0 = No Option Internal Option 1 -9 = 3-15 PSI and (2) Isolated Digital Inputs (SNAT 762 PSI) 0 = No Option Control Panel -P = Internal Control Panel SNAT 758 PAN (Keypad and Display) Enclosure Type* - 0 = Chassis (IP 00) 2 = NEMA 1 (IP 21) 3 = NEMA 1 w/Air Filters 5 = NEMA 12 (IP 54)

*Not all Enclosure Types are available for all units.



ORDERING INFORMATION - (Cont'd)

	Variable	Torque	■ - A	vailable C/F	Dimension		
480 VAC	HP	AMPS I _{RSQ}	NEMA 1	NEMA12* (see note)	NEMA 1 w/filters	CHASSIS	Reference
ACH501-003-4	3	4.8		m [‡]	N/A	•	R2 wall
ACH501-005-4	5	7.6		m,	N/A	•	mounted
ACH501-007-4	7.5	11		■ ‡	N/A	•	1
ACH501-010-4	10	14	8		N/A	•	R3
ACH501-015-4	15	21			N/A	•	1
ACH501-020-4	20	27			N/A	•	R4
ACH501-025-4	25	34			N/A	•	1
ACH501-030-4	30	40			N/A	*	R5
ACH501-040-4	40	52			N/A	•	1
ACH501-050-4	50	65			N/A	•	
ACH501-060-4	60	77			N/A	•	R5.5
ACH501-075-4	75	96	1		N/A	•	
ACH502-060-4	60	77		C/F			R6 floor
ACH502-075-4	75	96		C/F			mounted
ACH502-100-4	100	124		C/F			
ACH502-125-4	125	156		C/F			R7
ACH502-150-4	150	180		C/F		1	
ACH502-200-4	200	240		C/F			R8
ACH502-250-4	250	302		C/F			
ACH502-300-4	300	361		C/F			R9
ACH502-350-4	350	414		C/F	8		
ACH502-400-4	400	460		C/F			
NOTE: *NEMA 1 ‡ - R2 NE	2 units are MA 12 un	derated t	o 35°C unle have HOA s	ss oversized witch or spec	1 rating. ed pot on the		NEMA 1 nit.

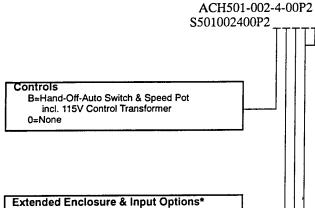
	Variabl	e Torque	■ - A	Di	
230 VAC	HP	AMPS IRSQ	NEMA 1	NEMA 12* (see note)	Dimension Reference
ACH501-002-2	2	7.5		■ ‡	R2 wall
ACH501-003-2	3	10.6			mounted
ACH501-005-2	5	16.8	-		R3
ACH501-007-2	7.5	24.2			
ACH501-010-2	10	30.9			R4
ACH501-015-2	15	46.			
ACH501-020-2	20	59.4			R5
ACH501-025-2	25	74.8			

Note: * - R2 NEMA 12 units do not have HOA switch or speed pot on the standard unit.

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ORDERING INFORMATION - (Cont'd)



A=Door Interlocked Disconnect Switch B=Door Interlocked Circuit Breaker C=Disconnect w/3% Line Reactor** D=Circuit Breaker w/3% Line Reactor** E=Input Terminal Block w/3% Line Reactor** F=Disconnect w/5% Line Reactor** G=Circuit Breaker w/5% Line Reactor** H=Input Terminal Block w/5% Line Reactor** 0=Extended Enclosure w/Input Terminal Block
*-One of these options must be selected

**-See page 8 for prices.

Bypass

A=Manual Bypass B=Manual Bypass w/Service Switch C=Automatic Bypass D=Automatic Bypass w/Service Switch 0=None

All bypass options require the Control Option B listed above.

Meters

A=Analog Voltmeter B=Analog Speed Meter Y=Ammeter (Sized to unit) Z=Two Ammeters (Sized to MOL's) 1=A+B 2=A+Y 3=A+Z 4=B+Y

5=B+Z 6=A+B+Y 7=A+B+Z 0=None

MOL			
HP*	ACH 501	HP*	ACH 502
	A=1.41 to 1.58		A=29.3 to 32.0
1	B=1.75 to 1.85	25	B=32.1 to 34.9
1	C=2.76 to 2.95		C=35.0 to 37.8
	D=2.96 to 3.21	30	D=37.9 to 41.7
2	E=3.22 to 3.48	i	E=41.8 to 45.9
	F=3.49 to 3.89		F=46.0 to 49.0
į	G=3.90 to 4.35	40	G=49.1 to 54.2
l	H=4.36 to 4.73	1	H=54.3 to 60.0
3	J=4.74 to 5.21		J=57.1 to 62.8
	K=6.47 to 6.95	50	K=62.9 to 69.1
5	L=6.96 to 8.09	1	L=69.2 to 75.0
	M=8.10 to 9.29	60	M=75.1 to 83.3
	N=9.30 to 10.4	1	N=83.4 to 86.9
7.5	P=10.5 to 10.9		P=87.0 to 92.9
10	Q=12.1 to 14.5	75	Q=93.0 to 100
	R=14.6 to 16.8	1	R=98 to 107.9
	S=16.9 to 18.4		S=108 to 113.9
15	T=18.5 to 20.9	100	T=114 to 125.9
	U=22.6 to 24.3	ł	U=126 to 138.9
20	V=24.4 to 27.2		V=139 to 153
	W=29.3 to 32.0	125	W=154 to 163
25	X=32.1 to 34.9	<u> </u>	X=164 to 180
	Y≃35.0 to 37.8	150	Y=175 to 194
30	Z=37.9 to 41.7	1	Z=195 to 220
	2=46.0 to 49.0	200	2=221 to 247
40	3=49.1 to 54.2	1	3=248 to 276
	4=57.1 to 62.8	250	4=277 to 307
50	5=62.9 to 69.1	1	5=308 to 345
	6=69.2 to 75.0	300	6=346 to 381
	7=83.4 to 86.9	350	7=382 to 420
	8=87.0 to 92.9		8=421 to 465
	9=93.0 to 100	1	0=None
	0=None		

* Horsepowers listed are estimated only for 460 volts. MOL's MUST be sized for the specific motor. Horsepowers for 230 V are half the horsepower at 460 V.

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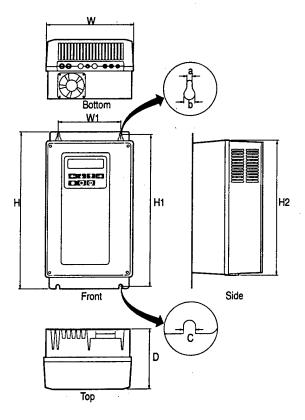
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DIMENSIONS ACH 501

Dimensions	R2		R	R3		R4		R5		R5.5	
	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm	
w	7-7/8	200	9-55/64	250	11-13/16	300	13-13/16	351	13-13/16	351	
W 1	5-29/32	150	6-57/64	175	8-55/64	225	10-27/32	275	10-27/32	275	
Н	14-17/64	362	16-3/4	425	19-31/32	507	23-3/4	603	23-3/4	603	
Н1	13-25/32	350	15-3/4	400	18-29/32	480	22-41/64	575	22-41/64	575	
Н2	12-9/32	312	14-31/32	380	18-7/64	460	21-45/64	551	21-45/64	551	
D	7-25/64	188	8-3/16	208	9-13/16	249	10-5/16	262	12-1/16	307	
a	15/64	7	5/16	9	5/16	9	5/16	9	5/16	9	
ь	35/64	14	45/64	18	45/64	18	45/64	18	45/64	18	
c	15/64	7	5/16	9	5/16	9	5/16	9	5/16	9	
Unit Weight	17 lbs	8 kg	31 lbs	14 kg	54 lbs	25 kg	74 lbs	34 kg	88 lbs	40 kg	
Shipping Weight	20 lbs	9 kg	34 lbs	15 kg	60 lbs	27 kg	80 lbs	36 kg	96 lbs	44 kg	

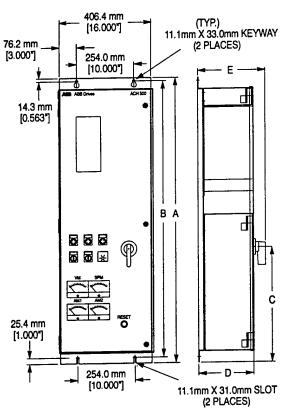
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DIMENSIONS ACH 501 w/Option Pack



	R2 & R3		R4 & R5		R5.5	
	mm	in.	mm	in.	mm	in.
A	1270.0	50.0	1651.0	65.0	1727.2	68.0
В	1230.3	48.4	1611.3	63.6	1687.5	66.6
C	510.2	20.1	675.3	26.6	809.5	31.9
D	240.2	9.5	298.0	11.7	343.0	13.5
E	292.4	11.5	350.2	13.8	395.2	15.6

Note: 230 volt 20 HP C.T./25 HP V.T. w/Bypass is R5.5 size optionpack.

	With Di	sconnect	With Bypass		
Drive Type	lbs	Kg	lbs	Kg	
R2	95	43.1	106	48.1	
R3	107	48.5	118	53.5	
R4	158	71.7	170	77.1	
R5	176	79.8	198	89.8	
R5.5	198	89.8	235	106.6	

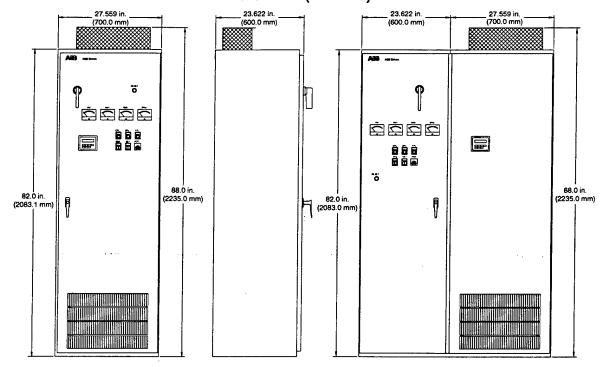
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DIMENSIONS ACH 502 (480 VAC)



FRONT R6 & R7 - all units R8 without bypass

LEFT SIDE

FRONT R8 with bypass R9 - all units

380 volt	R6		R7		R8		R9	
Dimensions	mm	in	mm	in	mm	in	mm	in
Н	1800	70.9	1800	70.9	2090	82.3	2215	87.2
W	800	31.5	800	31.5	800	31.5	856	33.7
D	470	18.5	470	18.5	470	18.5	636	25.0
Weight	210	463	245	540	315	695	345	761

Weights (480 VAC) Drive Type	With Disconnect				With Bypass			
	UNIT		SHIP		UNIT		SHIP	
	lbs	Kg	lbs	Kg	lbs	Kg	lbs	Kg
R6	510	231	560	254	555	252	605	274
R7	580	263	630	286	660	299	710	322
R8	650	295	700	318	1025	465	1125	510
R9	1000	454	1100	499	1200	544	1300	590

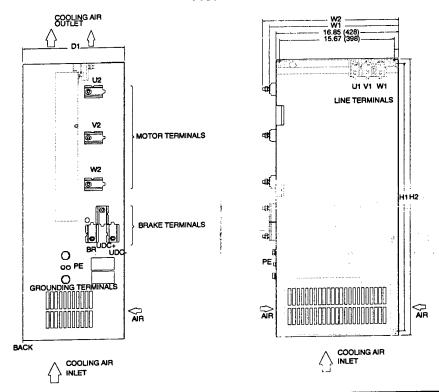
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ACH 500 HVAC AC DRIVES

DIMENSIONS ACH 504



	R6		R7		R8		R9	
Code	mm	in	mm	in	mm	in	mm	in
H1	675	26.57	959	37.76	1255	49.41	1608	63.31
H2	705	27.76	989	38.94	1285	50.59	1638	64.49
W 1	451	17.76	451	17.76	482	18.98	482	18.98
W2	473	18.62	473	18.62	512	20.16	512	20.16
D1	385	15.28	385	15.28	415	16.34	415	16.34

	R6	R7	R8	R9
Weight (lb)	137	196	278	364
Weight (kg)	62	89	126	165

Note: The control unit (consisting of the keypad/display and control interface board) included with the ACH 504 drive is not shown in the dimensional drawing above. The control interface may be mounted to the door of the enclosure that the ACH 504 is mounted in or inside the enclosure.

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Effective 4/1/93 Supersedes 6/15/92



ACH 500 HVAC AC DRIVES

NOTES

Air Treatment Corporation



HVAC Manufacturers Representative

Daniel M. Noone

6116 Merced Avenue, #303 • Oakland, CA 94611 OFFICE (510) 655-3990 • FAX (510) 655-7966 **EEAP Energy Survey of Army Industrial Facilities** Western Area Demilitarization Facility, HWAAP, Nevada APPENDIX K Carrier HAP Program Data F:\PROJ\1640316\WORD\ARMY_IND.SRV 941209

Σ

EEAP Energy Survey of Army Industrial Facilities Western Area Demilitarization Facility, HWAAP, Nevada

APPENDIX K Table of Contents

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Roof Construction Types
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DESIGN WEATHER PARAMETERS & MSHGs

Location: Hawthorne	, Nevada		12-20-	-94
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DESIGN PARAMETERS

City Name:	Hawthorne
Location:	
Latitude:	38.5 degrees
Longitude:	118.7 degrees
Elevation:	
Summer Design Dry-Bulb:	97.0 F
Summer Coincident Wet-Bulb:	62.0 F
Summer Daily Range:	36.0 F
Winter Design Dry-bulb	7.0 F
Atmospheric Clearness Number:	1.10
Average Ground Reflectance:	0.20
Soil Conductivity:	0.800 BTU/hr/ft/F
Local Time Zone (GMT +/- N hours).:	8.0 hours
Consider Daylight Savings Time?	N
First Month for Daylight Savings:	
Last Month for Daylight Savings:	-
Simulation Weather Data:	Reno (TMY)
Current data is	
	

DESIGN DAY MAXIMUM SOLAR HEAT GAINS (BTU/HR/SQFT)

Month	N	NNE	NE	ENE	E	ESE	SE	SSE	S
January February March April May June July August September October November December	22.2 27.0 32.1 37.4 41.0 51.1 41.9 39.2 33.5 28.0 22.7 20.1	22.2 27.0 32.1 79.9 115.8 127.6 113.3 76.6 33.5 28.0 22.7 20.1	22.2 57.0 115.2 154.6 177.3 186.1 178.4 152.1 105.9 59.4 22.7 20.1	97.5 144.8 184.6 215.9 226.9 228.9 223.8 208.3 177.7 136.2 90.4 77.0	166.0 215.1 240.0 244.3 242.8 237.9 236.0 233.1 223.7 204.0 171.5 147.2	233.9 254.8 265.0 245.7 224.8 214.9 221.4 237.8 252.9 249.9 223.5 218.5	264.8 275.2 257.7 217.8 187.3 171.8 181.2 209.8 245.5 264.0 264.1	278.3 268.8 235.0 180.5 137.2 118.8 134.2 174.9 226.0 259.0 274.7 276.2	277.5 260.3 219.2 160.4 114.6 95.6 110.3 154.6 214.0 253.6 274.5
Month	SSW	SW	WSW	 W	WNW	NW	NNW	HOR	Mult.
January February March April May June July August September October November December	279.3 268.5 234.6 181.9 138.8 119.7 134.0 175.5 227.4 259.1 271.5 274.4	267.6 274.9 257.0 218.7 185.8 170.7 181.4 210.9 248.5 263.2 261.7 256.4	231.5 258.3 265.3 247.0 227.2 216.0 221.3 238.1 249.4 249.1 229.8 219.0	171.9 214.9 238.4 242.0 239.2 236.7 236.3 233.3 229.6 201.1 168.8 151.4	96.3 136.7 186.8 214.7 227.8 229.5 223.8 207.6 174.7 140.8 92.1 75.3	22.2 62.8 114.7 157.5 182.1 188.1 178.0 152.9 105.5 53.3 22.7 20.1	22.2 27.0 32.1 74.2 111.6 126.2 113.8 74.0 33.5 28.0 22.7 20.1	153.9 204.7 249.2 279.8 293.5 295.0 289.0 274.2 242.2 202.1 154.5 132.2	1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00

Mult. = User-defined solar multiplier factor.

Note: The following Carrier HAP program input and output data represents building heating, ventilating and air conditioning (HVAC) energy use for selected WADF buildings. Computerized weather data required for the HAP program is available for selected cities; Hawthorne data is not computerized. Thus, computerized data available for Reno, Nevada, is used. Results of the HVA energy use simulations are adjusted for Hawthorne based on the heating and cooling degree days for Reno and for Hawthorne, Nevada, as reported in TM 5-785 Engineering Weather Data.

(Format is Dry-Bulb/Wet-Bulb F)

	January	February	March	April	May	June
	32.1/ 22.1 28.5/ 19.8	27.5/ 22.8 25.7/ 21.5 23.9/ 20.4 22.4/ 19.4 21.4/ 18.8 21.0/ 18.5 21.7/ 19.0 23.5/ 20.2 26.8/ 22.3 31.4/ 25.1 36.8/ 28.2 43.0/ 31.6 48.7/ 34.7 53.0/ 37.0 55.9/ 38.5 57.0/ 39.0 55.9/ 38.5 57.0/ 39.0 55.9/ 38.5 57.0/ 39.0 55.9/ 38.5 57.0/ 39.0 55.9/ 38.5 57.0/ 39.0 55.9/ 38.5 53.4/ 37.2 49.4/ 35.1 44.8/ 32.6 40.1/ 30.1 36.1/ 27.8 32.5/ 25.7 29.6/ 24.0	38.5/ 33.9 36.7/ 32.9 34.9/ 32.0 33.4/ 31.2 32.4/ 30.6 32.0/ 30.4 32.7/ 30.8 34.5/ 31.7 37.8/ 33.5 42.4/ 36.0 47.8/ 36.0 47.8/ 38.8 54.0/ 41.8 59.7/ 44.4 64.0/ 46.3 66.9/ 47.6 68.0/ 48.0 66.9/ 47.6 64.4/ 46.5 60.4/ 44.7 55.8/ 42.6 51.1/ 40.4 47.1/ 38.4 43.5/ 36.6 40.6/ 35.1	48.5/ 39.0 46.7/ 38.2 44.9/ 37.2 43.4/ 36.5 42.4/ 35.9 42.0/ 35.7 42.7/ 36.1 44.5/ 37.0 47.8/ 38.7 52.4/ 40.9 57.8/ 43.5 64.0/ 46.2 69.7/ 48.7 74.0/ 50.4 76.9/ 51.6 78.0/ 52.0 76.9/ 51.6 78.0/ 52.0 76.9/ 51.6 70.4/ 49.0 65.8/ 47.0 65.8/ 47.0 65.8/ 47.0 57.1/ 43.2 53.5/ 41.5 50.6/ 40.1	57.5/ 45.4 55.7/ 44.6 53.9/ 43.8 52.4/ 43.1 51.4/ 42.6 51.0/ 42.5 51.7/ 42.7 53.5/ 43.6 56.8/ 45.1 61.4/ 47.1 66.8/ 49.3 73.0/ 51.8 78.7/ 54.0 83.0/ 55.6 85.9/ 56.6 87.0/ 57.0 85.9/ 56.6	62.7/ 48.4 60.9/ 47.6 59.4/ 47.0 58.4/ 46.6 58.0/ 46.4 58.7/ 46.7 60.5/ 47.5 63.8/ 48.9 68.4/ 50.7 73.8/ 52.8 80.0/ 55.1 85.7/ 57.2 90.0/ 58.7 92.9/ 59.7 94.0/ 60.0 92.9/ 59.7 94.0/ 60.0 92.9/ 59.7 90.4/ 58.8 86.4/ 57.4 81.8/ 55.8 77.1/ 54.1 73.1/ 52.6 69.5/ 51.2
0 0	25.6/ 17.8	23.0/ 24.0				
r	July	August	September	October	November	December
	67.5/ 51.6 65.7/ 50.9 63.9/ 50.2 62.4/ 49.6 61.4/ 49.2 61.0/ 49.0 61.7/ 49.3 63.5/ 50.0 66.8/ 51.4 71.4/ 53.2 76.8/ 55.1 83.0/ 57.4 88.7/ 59.3 93.0/ 60.7 95.9/ 61.7 97.0/ 62.0 95.9/ 61.7 93.4/ 60.9 89.4/ 59.5 84.8/ 58.0 80.1/ 56.3 76.1/ 54.9 72.5/ 53.6 69.6/ 52.5	67.5/ 51.6 65.7/ 50.9 63.9/ 50.2 62.4/ 49.6 61.4/ 49.2 61.0/ 49.0 61.7/ 49.3 63.5/ 50.0 66.8/ 51.4 71.4/ 53.2 76.8/ 55.1 83.0/ 57.4 88.7/ 59.3 93.0/ 60.7 95.9/ 61.7 97.0/ 62.0 95.9/ 61.7 93.4/ 60.9 89.4/ 59.5 84.8/ 58.0 80.1/ 56.3 76.1/ 54.9 72.5/ 53.6 69.6/ 52.5	61.5/ 47.9 59.7/ 47.1 57.9/ 46.3 56.4/ 45.7 55.4/ 45.2 55.0/ 45.1 55.7/ 45.4 57.5/ 46.2 60.8/ 47.6 65.4/ 49.5 70.8/ 51.7 77.0/ 54.0 82.7/ 56.1 87.0/ 57.6 89.9/ 58.6 91.0/ 59.0 89.9/ 58.6 87.4/ 57.8 83.4/ 56.4 78.8/ 54.7 74.1/ 52.9 70.1/ 51.4 66.5/ 50.0 63.6/ 48.8	51.5/ 41.6 49.7/ 40.7 47.9/ 39.9 46.4/ 39.1 45.4/ 38.6 45.0/ 38.4 45.7/ 38.8 47.5/ 39.7 50.8/ 41.3 55.4/ 43.4 60.8/ 45.8 67.0/ 48.5 72.7/ 50.8 77.0/ 52.5 79.9/ 53.6 81.0/ 54.0 79.9/ 53.6 77.4/ 52.6 73.4/ 51.1 68.8/ 49.2 64.1/ 47.3 60.1/ 45.5 56.5/ 43.9 53.6/ 42.6	41.5/ 33.9 39.7/ 32.9 37.9/ 31.9 36.4/ 31.2 35.4/ 30.6 35.0/ 30.4 35.7/ 30.8 37.5/ 31.7 40.8/ 33.5 45.4/ 36.0 50.8/ 38.7 57.0/ 41.8 62.7/ 44.4 67.0/ 46.3 69.9/ 47.5 71.0/ 48.0 69.9/ 47.5 71.0/ 48.0 69.9/ 47.5 63.4/ 44.7 58.8/ 42.6 54.1/ 40.4 50.1/ 38.4 46.5/ 36.6 43.6/ 35.1	29.5/ 22.7 27.7/ 21.6 25.9/ 20.4 24.4/ 19.5 23.4/ 18.8 23.0/ 18.5 23.7/ 19.0 25.5/ 20.2 28.8/ 22.3 33.4/ 25.1 38.8/ 28.3 45.0/ 31.6 50.7/ 34.7 55.0/ 37.0 57.9/ 38.5 59.0/ 39.0 57.9/ 38.5 55.4/ 37.2 51.4/ 35.1 46.8/ 32.6 42.1/ 30.1 38.1/ 27.9 34.5/ 25.8 31.6/ 24.0

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TABLE 1. SIMULATION WEATHER DATA DESIGN PARAMETERS

_				
	City:	Reno		
	Location	Nevada		
	Location	mmiaa	1 Weterrological	Vear
	Type of Data	Typica.	I Wereninging I	Iear
	Tatitude	39.5	aeg	
	Longitude:	119.8	dea	
	Tougicuae	4400 0	f+	
	Elevation:	4490.0	IC	
*	Average Ground Reflectivity:	0.20		
	Tama Toma (CMT ±/= N hours)	8.0	hours	
	Daylight Savings Time Considered?	N		
*	Daylight Savings Time Considered	14		

^{* =} User-defined design parameters. All other values are fixed.

TABLE 2. DRY-BULB TEMPERATURE STATISTICS (F)

Month	Absolute Maximum	Average Maximum	Average	Average Minimum	Absolute Minimum	
January February March April May June July August September October	55.5 68.4 72.9 72.0 84.9 93.5 98.0 99.0 92.9 83.0	45.8 50.6 57.0 59.8 69.0 79.7 89.9 86.3 79.4 66.8	33.2 36.5 42.8 46.6 54.5 65.4 71.8 68.9 60.5 48.7	23.7 23.6 29.0 33.1 38.4 47.3 52.0 50.2 42.1 32.4	14.0 11.4 19.0 21.5 29.9 39.3 42.7 42.8 23.5 23.4	
November December	70.0 58.2	54.0 41.3	39.0 31.6	26.5 22.7	15.5 -0.4	

TABLE 3. DAILY TOTAL SOLAR RADIATION STATISTICS

Month		ly Total So (BTU/sqft) Average	olar] Minimum		Clearness N mensionless Average	
January February March April May June July August September October November December	1193.8 1639.4 2282.3 2751.2 2984.5 3017.3 2958.3 2747.6 2354.4 1815.5 1297.1	849.7 1136.6 1689.2 2077.9 2457.1 2725.3 2657.3 2421.3 2012.6 1414.4 899.5 678.5	566.7 492.2 898.3 936.7 1239.8 1774.0 1288.6 1816.6 788.8 692.0 373.3 211.7	0.756 0.785 0.815 0.830 0.826 0.820 0.811 0.797 0.790 0.772 0.747	0.614 0.614 0.681 0.673 0.700 0.740 0.741 0.748 0.747 0.687 0.597	0.378 0.295 0.389 0.288 0.345 0.480 0.358 0.602 0.310 0.358 0.244

Notes: * All solar data is daily total flux on a horizontal surface.

* Clearness number is (Daily Total Solar)/(Extraterrestrial Solar)
Values between 0.70 and 0.80 represent clear conditions.

Prepared by: Keller & Gannon	10-28-94
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WALL TYPE 1: (CUSTOM WALL)

Description..... Wall 1 Absorptivity..... 0.900

Layer Description	Thickness	Density	Spec.Ht	R-Val	Weight
Inside surface resistance 1/2-in (13 mm) gypsum board Airspace 8-in (203 mm) HW concrete Outside surface resistance	0.50 0.88 8.00	50.0 0.0 140.0	0.26 0.00 0.20	0.69 0.45 0.91 0.67 0.33	2.1 0.0 93.3
Totals	9.38			3.04	95.4

Thickness: in Density: lb/cuft Weight: lb/sqft R-value : (hr-sqft-F)/BTU Specific Heat: BTU/lb/F

WALL TYPE 2: (CUSTOM WALL)

Description....: Wall 2 Absorptivity..... 0.900

Layer Description	Thickness	Density	Spec.Ht	R-Val	Weight
Inside surface resistance 1/2-in (13 mm) gypsum board R-11 (RSI-1.9) batt insulation 12-in (203 mm) HW concrete Outside surface resistance	0.50 3.50 12.00	50.0 0.5 140.0	0.26 0.20 0.20	0.69 0.45 11.22 1.00 0.33	2.1 0.1 140.0
Totals	16.00			13.68	142.2

Thickness: in Density: lb/cuft Weight: lb/sqft R-value : (hr-sqft-F)/BTU Specific Heat: BTU/lb/F

Prepared by: Keller & Gannon HAP v3.06 ************************************			*****		0-28-94 Page 2 *****
WALL TYPE 3: (CUSTOM WALL)					
Description Wall Absorptivity 0.90					
Layer Description	Thickness	Density	Spec.Ht	R-Val	Weight
Inside surface resistance 12-in (203 mm) HW concrete Outside surface resistance	12.00	140.0	0.20	0.69 1.00 0.33	140.0
Totals	12.00			2.02	140.0
Thickness: in R-value : (hr-sqft-F)/BTU	Density: lb/cu Specific Heat:			t: 1b/	sqft
WALL TYPE 4: (CUSTOM WALL)					
Description Wall Absorptivity 0.90	4 0				
Layer Description	Thickness	Density	Spec.Ht	R-Val	Weight
Inside surface resistance 1-1/4" stucco & tile Board insulation 12-in (300 mm) HW concrete Outside surface resistance	1.50 0.88 12.00	116.0 2.0 140.0	0.22	0.30 6.08	14.5 0.1
Totals	14.38			8.39	154.6
Thickness: in R-value : (hr-sqft-F)/BTU	Density: lb/cu Specific Heat:			t: lb/s	sqft

## Prepared by: Refler & Gammon ### v3.06 ***********************************	Weight 2.1 0.0 140.0
Description: Wall 5 Absorptivity: 0.900 Layer Description Thickness Density Spec.Ht R-Va Inside surface resistance	Weight 2.1 0.0 140.0
Description: Wall 5 Absorptivity: 0.900 Layer Description Thickness Density Spec.Ht R-Va Inside surface resistance	Weight 2.1 0.0 140.0
Inside surface resistance 0.6 1/2-in (13 mm) gypsum board 0.50 50.0 0.26 0.4 Airspace 2.50 0.0 0.00 0.9 12-in (300 mm) HW concrete 12.00 140.0 0.20 1.0 Outside surface resistance - 0.3 Totals 15.00 3.3 Thickness: in Density: lb/cuft Weight: lb R-value: (hr-sqft-F)/BTU Specific Heat: BTU/lb/F WALL TYPE 6: (CUSTOM WALL) Description: Wall 6 Absorptivity: 0.900	2.1 0.0 140.0
1/2-in (13 mm) gypsum board 0.50 50.0 0.26 0.4 Airspace 2.50 0.0 0.00 0.99 12-in (300 mm) HW concrete 12.00 140.0 0.20 1.09 Outside surface resistance - 0.33 Totals 15.00 3.33 Thickness: in Density: lb/cuft Weight: lb R-value: (hr-sqft-F)/BTU Specific Heat: BTU/lb/F WALL TYPE 6: (CUSTOM WALL) Description: Wall 6 Absorptivity: 0.900	2.1 0.0 140.0
Totals 15.00 3.33 Thickness: in Density: lb/cuft Weight: lb R-value: (hr-sqft-F)/BTU Specific Heat: BTU/lb/F WALL TYPE 6: (CUSTOM WALL) Description: Wall 6 Absorptivity: 0.900	
Thickness: in Density: lb/cuft Weight: lb R-value : (hr-sqft-F)/BTU Specific Heat: BTU/lb/F WALL TYPE 6: (CUSTOM WALL) Description: Wall 6 Absorptivity: 0.900	sqft
Description: Wall 6 Absorptivity: 0.900	
Absorptivity: 0.900	
Layer Description Thickness Density Spec.Ht R-Va	
	Weight
Inside surface resistance 0.69 8-in (203 mm) HW concrete 8.00 140.0 0.20 0.69 Outside surface resistance 0.39	93.3
Totals 8.00 1.66	93.3
Thickness: in Density: lb/cuft Weight: lb/R-value : (hr-sqft-F)/BTU Specific Heat: BTU/lb/F	
WALL TYPE 7: (CUSTOM WALL)	
Description: Wall 7 Absorptivity: 0.900	
Layer Description Thickness Density Spec.Ht R-Va	Weight
Inside surface resistance 0.69	116.7
Totals 10.00 1.8	
Thickness: in Density: lb/cuft Weight: lb/R-value : (hr-sqft-F)/BTU Specific Heat: BTU/lb/F	116.7

epared by: Keller & Gannon P v3.06 ************************************			*****		1-01-94 Page 4 *****
LL TYPE 8: (CUSTOM WALL)					
scription Wall sorptivity 0.90	. 8				
Layer Description	Thickness	Density	Spec.Ht	R-Val	Weight
side surface resistance 2-in (13 mm) gypsum board 1tt insulation 2-in (13 mm) gypsum board 1tside surface resistance	0.50 0.88 0.50	0.5	0.20 0.26	2.80	2.1 0.0 2.1
tals	1.88			4.72	
hickness: in \-value : (hr-sqft-F)/BTU	Density: lb/cu Specific Heat:	ft BTU/lb/		nt: lb/	sqft
ALL TYPE 9: (CUSTOM WALL)			· •		
escription Wall osorptivity 0.90	. 9)0				
Layer Description	Thickness	Density	Spec.Ht	R-Val	Weight
nside surface resistance 5-in (406 mm) HW concrete utside surface resistance	16.00	140.0	0.20	0.69 1.33 0.33	186.7
otals	16.00			2.35	186.7
Thickness: in R-value : (hr-sqft-F)/BTU	Density: lb/cu Specific Heat:			nt: lb/	sqft

repared by: Keller & Gannon AP v3.06 ************************************	****	****	*****		1-01-94 Page 5 *****
ALL TYPE 10: (CUSTOM WALL)					
escription: Wall 10 bsorptivity: 0.900					
Layer Description	Thickness	Density	Spec.Ht	R-Val	Weight
nside surface resistance 2 gage steel deck -14 (RSI-2.5) board insulation 2 gage steel deck utside surface resistance	0.03 2.00 0.03		0.12 0.22 0.12	13.89	0.3
otals	2.07			14.91	3.1
	sity: lb/cu cific Heat:		_	nt: lb/	sqft

ROOF CONSTRUCTION TYPES

ROO Prepared by: Keller & Gannot HAP v3.06 ************************************			****		1-02-94 Page 1 *****
ROOF TYPE 1: (CUSTOM ROOF)					
Description: Room Absorptivity: 0.90	f & Ceiling 00				
Layer Description	Thickne	s Density	Spec.Ht	R-Val	Weight
Inside surface resistance Acoustic Tile Airspace 4-in (102 mm) LW concrete Board insulation Built-up roofing Outside surface resistance	24.(4.(3.(75 18.0 00 0.0 00 40.0 00 2.0 38 70.0	0.00 0.20 0.22	0.69 3.73 0.91 3.33 20.83 0.33	1.1 0.0 13.3 0.5 2.2
Totals	32.:	.3		30.16	17. 1
Thickness: in R-value : (hr-sqft-F)/BTU ROOF TYPE 2: (CUSTOM ROOF)	Density: lb, Specific Hea		Weigl F 	ht: 1b/	sqft
Description: Roof Absorptivity: 0.90	f 2 - 117-3 F1	angible Ro	of 1:12 8	Slope	
Layer Description	Thicknes	s Density	Spec.Ht	R-Val	Weight
Inside surface resistance 22 gage steel deck Board insulation Built-up roofing Outside surface resistance	3.0	- 3 489.0 0 2.0 8 70.0		0.69 0.00 20.83 0.33 0.33	1.4 0.5 2.2
Totals	3.4	1		22.18	4.1
Thickness: in R-value : (hr-sqft-F)/BTU	Density: lb/ Specific Hea			nt: lb/s	sqft

ROOF CONSTRUCTION TYPES

Prepared by: Keller & Gannor HAP v3.06 ************************************		****	*****	1	1-02-94 Page 2 *****
ROOF TYPE 3: (CUSTOM ROOF)					
Description Roof Absorptivity 0.20		ing Corri	idor (Cov	vered)	
Layer Description	Thickness	Density	Spec.Ht	R-Val	Weight
Inside surface resistance 16-in (406 mm) HW concrete Board insulation Built-up roofing Outside surface resistance					186.7 0.5 2.2
Totals	19.38			23.52	189.4
Thickness: in R-value : (hr-sqft-F)/BTU	Density: lb/cu Specific Heat:	ft BTU/lb/F	Weigh	t: 1b/s	sqft
ROOF TYPE 4: (CUSTOM ROOF)					
Description: Roof Absorptivity: 0.90	4 - 117-3 WCs,	Corridor	, Office	s 1:12	Slope
Layer Description	Thickness	Density	Spec.Ht	R-Val	Weight
Inside surface resistance Acoustic Tile Airspace 22 gage steel deck Board insulation Outside surface resistance	0.75 36.00 0.03 3.00	0.0	0.00 0.12	0.91 0.00	1.1 0.0 1.4 0.5
Totals	39.78			26.49	3.0
	Density: lb/cu	ft BTU/lb/F	Weigh	t: lb/s	qft

ROOF CONSTRUCTION TYPES

Prepared by: Keller & Gannon HAP v3.06		****	*****	:	1-02-94 Page 3 *****
ROOF TYPE 5: (CUSTOM ROOF)					
Description Ceil: Absorptivity 0.900	ing Partition T	oilet Are	ea 117-5		
Layer Description	Thickness	Density	Spec.Ht	R-Val	Weight
Inside surface resistance 1/2-in (13 mm) gypsum board R-11 (RSI-1.9) batt insulation 1/2-in (13 mm) plywood Outside surface resistance	0.50 3.50 0.50	50.0 0.5 34.0	0.26	11.22 0.62 0.33	2.1 0.1 1.4
Totals	4.50			13.31	
Thickness: in R-value : (hr-sqft-F)/BTU ROOF TYPE 6: (CUSTOM ROOF)	Density: lb/cu Specific Heat:	ft BTU/lb/I	Weigh	nt: 1b/	sqft
Description: Roof Absorptivity: 0.900	6 - 117-5 Work	Room & I	Mechanica	l Room	Roofs
Layer Description	Thickness	Density	Spec.Ht	R-Val	Weight
Inside surface resistance 8-in (203 mm) HW concrete Board insulation Built-up roofing Outside surface resistance	8.00 3.00 0.38	140.0 2.0 70.0	0.20 0.22 0.35	0.69 0.67 20.83 0.33 0.33	93.3 0.5 2.2
Totals	11.38			22.85	96. 0
Thickness: in R-value : (hr-sqft-F)/BTU	Density: lb/cu Specific Heat:	ft BTU/lb/F		t: 1b/s	sqft

HAP v									12-2 Pag	20-94 ge 1
GENEF Name Floc Buil Wind Part LIGHT Over Lamp	e: 1. Wor Area	Tet Lab Offi : 237.0 : 70.0 ? N : Recessed : 690.0	ice & H) sqft) lb/sq , , , , ,	all ft	******* SCHEDULE Lightin Task Li People. Equipme Misc. S Misc. L INFILTRA Cooling Heating	g: ghts.: nt: ens: atent: TION	Light Light Light Light Light	s s s s s o.00 (******** CFM/sqft CFM/sqft	·***
Task PEOPI Occu Acti Sens Late OTHER Equi Misc	Lighting	: 0.00 : 2 : Office Wo : 245.0 : 205.0 : 3.00 : 0.0	W/sqf Peopl BTU/h BTU/h W/sqf BTU/h BTU/h	e] r r t	Typical When Fa FLOOR Type Perimet Slab Fl Floor R Insulat	n On.? er oor Are	Slab O 	0.00 C N n Grad	CFM/sqft	
WALL Exp	Gross Area (sqft)	WALL Type	W Type	INDOV Qty		Type	VINDOW Qty	Shade	Any Doors?	
S E W	177.8 51.3 51.3	5 5 5	1 1 1	0 0 0	- - -	1 1 1	0 0 0		N N N	
ROOF Exp	Slope Gro (deg)	oss Area (sqft)	ROOF Type	SKY Type	LIGHT Qty	 				- -
HOR		237.0	1 =====] 1	0	 			=======	
No pa	rtition data	for this s	pace.							

Prepa: HAP v	red by:	Kelle	r & Ganno	n							0-94
	3.UG					د باد باد باد باد باد باد باد باد				Pag	re 1
GENERA Name Floor Build Windo Parts LIGHT	AL: r Area ding Wei ows Shad itions U ING	ght.: ed? sed.?	70.	Fume I O sqft O lb/so N	Hood	******** SCHEDULE Lightir Task Li People. Equipme Misc. S Misc. I	ghts.:	Light Light Light Light Light	:s :s :s	*****	****
Overhead Fixture: Recessed Lamp Wattage: 100.0 W Ballast Mult: 1.00 Task Lighting: 0.00 W/sqft PEOPLE Occupancy: 1 People Activity Level.: Office Work Sensible: 245.0 BTU/hr Latent: 205.0 BTU/hr OTHER LOADS Equipment: 7.00 W/sqft Misc. Latent: Lights INFILTRATION Cooling: 0.00 CFM/sqft Heating: 0.00 CFM/sqft Typical: 0.00 CFM/sqft When Fan On.? N FLOOR Type:Slab On Grade Perimeter: 12.5 ft Slab Floor Area: 89.0 sqft Floor R-Value: 0.50 Insulation R-value: 7.00 Insulation R-value: 7.00											
WALL Exp	Gross An (sq		WALL Type	W Type	INDOW Qty		Type	INDOW Qty	Shade	Any Doors?	===
S E =====		3.7 3.8	5 5	1	0	-	1 1	0 0		N N	
	Slope (deg)	Gros	s Area (sqft)	ROOF Type	SKY Type	LIGHT Qty	 				====
HOR			89.0	1	1	0					·
No par	tition d	lata f	or this s	pace.							

HAP	red by: Kell					· 			Pag	
		*******	****				*****	*****	*****	***
GENER					CHEDULE					
	3. 1				Lightin					
	r Area		0 sqft		Task Li					
	ding Weight.		0 lb/s		People.					
	ows Shaded		N		Equipme					
	itions Used.	•	Y		Misc. S					
LIGHT		. Danassa			Misc. I		Light	s		
	head Fixture				NFILTRA					
Lamp	Wattage	70.			Cooling	[• • • • • • • • • • • • • • • • • • •			FM/sqft	
	ast Mult		_		Heating				CFM/sqft	
PEOPL	Lighting	: 0.0	0 W/sqf		Typical				CFM/sqft	
		•	1 Deem 1		When Fa	n On.?		N		
	pancy		1 Peopl		LOOR		17-1-0		1_	
ACLI	vity Level ible	: OITICE W	OEK		Type					c.
	nt		O BIU/h	IL .	Perimet Slab Fl				7.9	
	LOADS	. 203.	O BIO/I		Floor R				73.0 :	sqrt
	pment	• 7 0	0 W/sqf		Insulat				0.50 7.00	
	Sensible		O BTU/h		Insulac	TON K-V	arue.	• • • •	7.00	
	. Latent		BTU/h							
=====				 -====:						
WALL	Gross Area	WALL	l w	VINDOW		l w	INDOW		Any	
Exp	(sqft)	Туре	Type	Qty	Shade	Type		Shade		
S =====	71.1	5 =========	1	0		1 ======	0	-	N ==========	
ROOF	Slope Gr	oss Area	ROOF	SKY	LIGHT	1				
Exp	(deg)	(sqft)	Type	Туре	Qty					•
HOR	_ 	73.0	1 	1	0	 				
PARTI	TION LOADS		Type 1		_	T	ype 2			
Tyne	• • • • • • • • • • • •	· Dart	ition			Ceil	ina			
	• • • • • • • • • • • •		86.4	saft		CCII	-	sqft		
	le				/sqft/I	r ·			r/sqft/F	
	m Space Temp		97.0		, -41/1	•	75.0		r/agrc/r	
	le Air Temp (97.0	_			55.0			
	m Space Temp		45.0				75.0	_		
Outsid	le Air Temp (Min:	7.0	_			54.0	_		
=====						======	=====	=====	=======	===

Prepared by: Keller & Gannon	12-20-94
HAP v3.06	Dage 1
*****************	*******
GENERAL SCHEDULES	į
Name: 4. Instrument Lab Lighting: Lights	
Floor Area: 550.0 sqft Task Lights:: Lights	
Building Weight: 70.0 lb/sqft People: Lights	
Windows Shaded? N Equipment: Lights	
Partitions Used.? Y Misc. Sens: Lights	
LIGHTING Misc. Latent: Lights	
Overhead Fixture: Recessed INFILTRATION	
Lamp Wattage: 1030.0 W Cooling: 0.00 CFM/s	aft
Ballast Mult: 1.00 Heating: 0.00 CFM/s	aft
Task Lighting: 0.00 W/sqft Typical: 0.00 CFM/sc	11 C 7ft
PEOPLE When Fan On.?	1.0
Occupancy: 4 People FLOOR	
Activity Level: Office Work Type:Slab On Grade	
	0 0 01
Tatont	0.0 ft
	50.0 sqft
_ ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' '	0.50
	7.00
Misc. Latent: 0.0 BTU/hr	
No external wall or window data for this space.	
	-=====
ROOF Slope Gross Area ROOF SKYLIGHT	
Exp (deg) (sqft) Type Type Qty	
HOR - 550.0 1 1 0	
	======
PARTITION LOADS Type 1 Type 2	4
Type Partition Ceiling	
Area	
U-value 0.0 sqft 0.0 sqft	
U-value	t/F
Outside Pier Breeze O. V	
Outside Air Temp @ Max: 97.0 F	
Minimum Space Temp: 45.0 F	
Outside Air Temp @ Min: 7.0 F 54.0 F	
	======

DIACE DESCRIPTION	
Prepared by: Keller & Gannon HAP v3.06	12-20-94 Page 1
********************	*****
GENERAL SCHEDULES	
Name: 5. Biochemical Lab Lighting: Lights	
Floor Area: 963.0 sqft Task Lights: Lights	
Building Weight:: 70.0 lb/sqft People: Lights	
Windows Shaded? N Equipment: Lights	
Partitions Used.? N Misc. Sens: Lights	
LIGHTING Misc. Latent: Lights	
Overhead Fixture: Recessed INFILTRATION	
Lamp Wattage: 2750.0 W Cooling: 0.00 CFM/s	eaft
Ballast Mult: 1.00 Heating: 0.00 CFM/s	
Task Lighting: 0.00 W/sqft Typical: 0.00 CFM/s	
PEOPLE When Fan On.? N	sqr c
· · · · · · · · · · · · · · · · · · ·	
Activity Level: Office Work Type:Slab On Grade Sensible: 245.0 BTU/hr Perimeter:	0.0 ft
· · · · · · · · · · · · · · · · · · ·	
	963.0 sqft
OTHER LOADS Floor R-Value:	0.50
Equipment: 7.00 W/sqft Insulation R-value:	7.00
Misc. Sensible: 0.0 BTU/hr	
Misc. Latent: 0.0 BTU/hr	
No external wall or window data for this space.	
ROOF Slope Gross Area ROOF SKYLIGHT	
Exp (deg) (sqft) Type Type Qty	
HOR - 963.0 1 1 0	
No partition data for this space.	

Prepared by: Keller & G	SPACE DESCRIPTION	12-20-94
HAP v3.06		Page 1
*******	**********	
GENERAL	SCHEDULES	
Name: 6. Wet Cher		
Windows Shaded?	70.0 lb/sqft People: Lights	
	N Equipment: Lights	
Partitions Used.?	Y Misc. Sens: Lights	
LIGHTING	Misc. Latent: Lights	
Overhead Fixture: Reces		
	340.0 W Cooling: 0	.00 CFM/sqft
Ballast Mult:	1.00 Heating: 0	.00 CFM/sqft
Task Lighting:		.00 CFM/sqft
PEOPLE	When Fan On.?	N
Occupancy:	1 People FLOOR	
Activity Level: Office	ce Work Type:Slab On	Grade
Sensible 2	245.0 BTU/hr Perimeter	
Latent 2	05.0 BTU/hr Slab Floor Area	
OTHER LOADS	Floor R-Value	
·	7.00 W/sqft Insulation R-value	
Misc. Sensible:	0.0 BTU/hr	7.00
Misc. Latent:	0.0 BTU/hr	
misc. Datent	0.0 BIO/III	
No external wall or wind	low data for this space.	
Exp (deg) (sqft) Type Type Qty	
HOR - 137.		
HOR - 137.	0 1 1 0	
PARTITION LOADS	Type 1 Type 2	
_		
Type:		_
Area	72.0 sqft 0.0 s	aft
U-value		ŤU/hr/sqft/F
Maximum Space Temp:	97.0 F 75.0 F	
Outside Air Temp @ Max:	97.0 F 55.0 F	•
Minimum Space Temp:	45.0 F 74.0 F	
Outside Air Temp @ Min:	7.0 F 54.0 F	

Prepared by: Keller & Ga HAP v3.06			12-20-94 Page 1
**************************************	& Oven Room Light 72.0 sqft Tash 70.0 lb/sqft Peor Miscon Miscon INFII 30.0 W Cool 1.00 Heat When 2 People FLOOR Work Type	cal: 0.00 Fan On.? N L :Slab On Gr	CFM/sqft CFM/sqft CFM/sqft
Sensible: 24 Latent 20 OTHER LOADS Equipment:	15.0 BTU/hr Peri 15.0 BTU/hr Slab Floo 7.00 W/sqft Insu 0.0 BTU/hr 0.0 BTU/hr	meter	0.0 ft 172.0 sqft 0.50
No external wall or windo	ow data for this sp		
ROOF Slope Gross Area Exp (deg) (sqft)		T ty	
HOR - 172.0	1 1	0	
PARTITION LOADS	Type 1		
Type	artition 90.0 sqft 0.296 BTU/hr/sq 97.0 F 97.0 F 45.0 F 7.0 F	Ceiling 0.0 sqf ft/F 0.010 BTU 75.0 F 55.0 F 74.0 F 54.0 F	

	ared by: I 73.06	Keller	& Ganno	on							20-94
	*********	*****	*****	*****	*****					Pag	je l
GENER	RAL					CHEDULE	S.				****
Name	e 8	3,31,3	2. Lunch	Rm Sr		Lightir		Light	s		
	or Area		391.	0 sqft		Task Li					
Buil	lding Weig	ght.:	70.	0 lb/s	qft	People.					
Wind	lows Shade	ed?		N	_	Equipme					
	itions Us	sed.?		Y		Misc. S					
LIGHT						Misc. I	atent:	Light	s		
	head Fixt					NFILTRA		_			
Lamp	Wattage.	•••	488.			Cooling			0.00 CH	M/sqft	
	ast Mult.		1.0			Heating			0.00 CH		
	Lighting	[•••	0.0	0 W/sq		Typical			0.00 CF	M/sqft	
PEOPL						When Fa	n On.?		N		
	pancy			4 Peop		LOOR	_				
	vity Leve					Type					
	ible nt			O BTU/		Perimet				18.8	
	LOADS	• • • •	270.	O BTU/		Slab Fl	oor Are	ea	• • • •	391.0	sqft
	pment		2 0	0 W/am	c_	Floor R	-value.	• • • • •	• • • •	0.50	
	. Sensibl		3.0	0 W/sq: 0 BTU/1	L L	Insulat	ion k-v	arue.	• • • •	7.00	
	. Latent.		0.	0 BTU/1	יוד דר						
	=======				 ======						
WALL	Gross Ar	ea	WALL	i v	WODNIN		l w	INDOW		Any	
Exp	(sqf	t)	Type		Qty	Shade	Type			Doors?	
		<u>-</u>						~~ <i>_</i>			
W =====:	169 =======	.2 =====	2 =======	1 =======	0	-	1	0		N	
ROOF	Slope	Gross	s Area	ROOF	SKY	LIGHT	1				
Exp	(deg)	1	(sqft)	Type	Туре	Qty					
							Ì				4
HOR	_	=====	391.0 =======	1 ======	1 =====	0 ======	 ======				
PARTI	TION LOAD	S	7	Type 1			T	ype 2			
Type.			: Part	tition			Ceil	 ina			
	• • • • • • • •			187.2	saft		CCII	_	sqft		
U-valu	ıe		:			:/sqft/l	ह			/sqft/F	
Maximu	ım Space I	remp	:	97.0		, 1 - / -	-	75.0		, / -	
Outsid	de Air Ter	npē m	fax:	97.0				55.0			
Minimu	ım Space T	Temp	:	45.0	F			74.0			
Outsid	de Air Tem	np @ M	lin:	7.0	F			54.0			
=====		=====	=======			======		-====			

HAP						****		*****	12-2 Pag	20-94 ge 1
***** GENER Name Floo Buil Wind Part LIGHT Over	*************** AL : 9,28. or Area ding Weight.: lows Shaded? itions Used.?	Lunch & C 2010.0 70.0 N	Coat Ro sqft lb/sq	ooms	******** SCHEDULE Lightin Task Li People. Equipme Misc. S Misc. L TNFILTRA' Cooling	g: ghts.: nt: ens: atent:	Light Light Peopl Peopl Light Light	s e e s s	********* FM/sqft	****
Ball Task PEOPL	ast Mult: Lighting:	1.00			Heating Typical When Far	:		0.00 C	FM/sqft FM/sqft	
Acti Sens Late OTHER Equi Misc	vity Level: ible: nt: LOADS pment: . Sensible: . Latent:	Seated at 230.0 120.0 3.00 0.0		r r t	Type Perimet Slab Flo Floor R Insulat	er oor Are -Value	a	• • • •	97.4 2010.0 0.50 7.00	
WALL Exp	Gross Area (sqft)	WALL Type	W Type	INDOW Qty		Type	VINDOW Qty	Shade	Any Doors?	
N E W	645.6 76.8 446.4	2 2 2	1 1 1	0 0 0	<u>-</u>	1 1 1	0 0 0	- - -	N N N	
ROOF Exp	Slope Gro	ss Area (sqft)	ROOF Type	SKY Type	LIGHT Qty					
HOR	_	2010.0	1	1 =====	0					====
No pa	rtition data :	for this s	pace.							

	ared by:	Kelle:	r &	Ganno	n						12-2	
											Pag	e 1
HAP **** GENER Name Floo Buil Wind Part LIGHT Over Lamp Ball Task PEOPI OCCU Acti Sens Late OTHER	v3.06 ****** RAL COT Area Iding Weilows Shade titions UFING THOSE THO	***** 10,11: ght.: ed? sed.? ture:: g:	**** ,12, Rece	***** 25. W 1081. 70. 1.00 0.00 295.0 455.0	****** mn Loc 0 sqft 0 lb/s N N 0 W 0 0 W/sq: 5 Peop: ork 0 BTU/i	kers qft ft le F	SCHEDULI Lightin Task Lighting People. Equipments. S Misc. I INFILTRA Cooling Heating Typical When Far FLOOR Type Perimet Slab Fl Floor R	ights.: ights.: ights.: int: int: int: in On.? int: int	Light Light Peopl Peopl Light Light	s.e.e.s.s.s.o.oo C 0.00 C 0.00 C 0.00 C N n Grad	Pag ******* FM/sqft FM/sqft FM/sqft	e 1 ****
Misc	pment Sensib Latent	le:		0.0	W/sqi BTU/i BTU/i	ır	Insulat	ion R-v	alue.	•••	7.00	
WALL Exp	Gross Ai			ALL /pe		INDOW Qty		Type	INDOW Qty	Shade	Any Doors?	===
N E =====	250 318			4	1	0 0		1 1	0 0	-	N N	
ROOF Exp	Slope (deg)	Gros	s Ar (sqf		ROOF Type	SKY Type	LIGHT Qty	 				·===
HOR	- - -		1081	.0	1	1	0	<u> </u>				
No par	rtition d	lata f	or t	his s	pace.							===

Prepared by: Kel		n ******	*******	****	*****	****	12-20-94 Page 1
GENERAL Name: 13, Floor Area Building Weight Windows Shaded. Partitions Used LIGHTING Overhead Fixtur Lamp Wattage Ballast Mult Task Lighting PEOPLE Occupancy Activity Level. Sensible Latent OTHER LOADS Equipment Misc. Sensible. Misc. Latent	14,15,26. M .: 1137: 70: 70: 1.00: 1.00: 30: Medium W .: 295.0 .: 455.0 .: 1.00.	O sqft O lb/sqft N O W O W/sqft O People	SCHEDULE Task Li Task Li People. Equipme Misc. S Misc. L INFILTRA Cooling Heating Typical When Far FLOOR Type Perimeto Slab Floor R	gghts ghts nt ens atent: TION n On.? er oor Are -Value.	Lights Lights People People Lights Lights 0.	00 CFN 00 CFN N Grade .: .:	1/sqft 1/sqft 1/sqft 33.4 ft 1137.0 sqft 0.50 7.00
WALL Gross Area Exp (sqft)	WALL Type	WIN Type Q	DOW ty Shade	W Type	INDOW Qty Sl	nade	Any Doors?
E 334.0	4	1	0 -	1	0	-	N
ROOF Slope G	ross Area (sqft)		SKYLIGHT Ype Qty			====	
HOR -	1137.0	1	1 0			·	
No partition data	for this s	pace.					

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***********************	******
GENERAL SCHEDULES Name: 16. Men's Toilet Lighting: Lights	
m1	
Floor Area: 80.0 sqft Task Lights: Lights	
Building Weight: 70.0 lb/sqft People: Lights	
Windows Shaded? N Equipment: Lights	
Partitions Used.? N Misc. Sens: Lights	
LIGHTING Misc. Latent: Lights	
Overnead Fixture: Recessed INFILTRATION	
Lamp Wattage: 90.0 W Cooling: 0.00 C	CFM/sqft
Ballast Mult: 1.00 Heating: 0.00 C	FM/sqft
rask Lighting: 0.00 W/sqft Typical: 0.00 C	FM/sqft
PEOPLE When Fan On.? N	, - 4-
Occupancy 2 People FLOOR	
Activity Level: Seated at Rest Type:Slab On Grad	e
Sensible 230.0 BTU/hr Perimeter	0.0 ft
Latent 120.0 BTU/hr Slab Floor Area .	80.0 sqft
OTHER LOADS Floor R-Value	0.50
Equipment 0.00 W/saft Insulation P-value	7.00
Misc. Sensible: 0.0 BTU/hr	7.00
Misc. Latent: 0.0 BTU/hr	
No external wall or window data for this space.	
ROOF Slope Gross Area ROOF SKYLIGHT	
Exp (deg) (sqft) Type Type Qty	
HOR - 80.0 1 1 0	
No partition data for this space.	

	CE DESCRIPTION
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***********	****************
GENERAL	SCHEDULES
Name: 17. Women's Toilet	Lighting: Lights
Floor Area: 76.0 sqf	t Task Lights.: Lights
Building Weight.: 70.0 lb/	sqft People: Lights
Windows Shaded? N	Equipment: Lights
Partitions Used.? N	Misc. Sens: Lights
LIGHTING	Misc. Latent: Lights
Overhead Fixture: Recessed	INFILTRATION
Lamp Wattage: 90.0 W	Cooling: 0.00 CFM/sqft
Ballast Mult: 1.00	Heating: 0.00 CFM/sqft
Task Lighting: 0.00 W/s	qft Typical: 0.00 CFM/sqft
PEOPLE	When Fan On.?
Occupancy 2 Peop	ple FLOOR
Activity Level: Seated at Res	Type:Slab On Grade
Sensible 230.0 BTU	/hr Perimeter 0.0 ft
Latent 120.0 BTU	/hr Slab Floor Area: 76.0 sqft
OTHER LOADS	Floor R-Value 0.50
Equipment: 0.00 W/so	Ift Insulation R-value: 7.00
Misc. Sensible: 0.0 BTU	hr
Misc. Latent: 0.0 BTU	
No external wall or window data i	for this space.
ROOF Slope Gross Area ROOF	F SKYLIGHT
Exp (deg) (sqft) Type	
HOR - 76.0 1	1 0
No partition data for this space.	

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******	ر الرابي الرابي الرابي الرابية الرابية الرابية الرابية الرابية الرابية الرابية الرابية الرابية الرابية الرابية			Page 1
GENERAL Name: 18. Of Floor Area: Building Weight: Windows Shaded.? Partitions Used.? LIGHTING Overhead Fixture: Lamp Wattage: Ballast Mult: Task Lighting: PEOPLE Occupancy: Activity Level: Sensible: Latent OTHER LOADS Equipment Misc. Sensible Misc. Latent	117.0 sqft 70.0 lb/sqft N N Recessed 340.0 W 1.00 0.00 W/sqft 2 People Office Work 245.0 BTU/hr 205.0 BTU/hr 3.00 W/sqft 0.0 BTU/hr 0.0 BTU/hr	Equipment: Misc. Sens: Misc. Latent: Mi	Lights Lights Lights Lights Lights 0.00 CF 0.00 CF 0.00 CF	M/sqft M/sqft 0.0 ft
No external wall or	window data for the	his space.		
TR / 7 " .	s Area ROOF SI (sqft) Type Tyl	KYLIGHT pe Qty		
HOR -	117.0 1	1 0		
No partition data for	or this space.		========	========

HAP	ared by: Kel 73.06	ler & Ganno	n					12-20-94 Page 1
GENER Name Floo Buil Wind Part LIGHT Over Lamp Ball Task PEOPL Occu Acti Sens Late OTHER Equi Misc	AL or Area ding Weight lows Shaded. itions Used TING head Fixtur Wattage ast Mult Lighting	:: 133: 70? .? e: Recessed .: 340: 0.0 .: 0.0 .: 245: 205: 3.00	W/sqft People	Equipme Misc. S Misc. L INFILTRA Cooling Heating Typical When Fa	ghts.: ont: ens: atent: TION: n On.? er oor Are	Lights Lights Lights Lights Lights O O O Slab On	.00 CF .00 CF .00 CF N Grade	M/sqft M/sqft M/sqft 12.2 ft 133.0 sqft 0.50 7.00
WALL Exp	Gross Area (sqft)	WALL Type		DOW ty Shade	Type	VINDOW Qty	Shade	Any Doors?
E	109.8	2	1	0 -	1	0		N N
ROOF Exp		ross Area (sqft)		SKYLIGHT Ype Qty				
HOR		133.0	1	1 0				
No pa:	rtition data	a for this s	pace.					

Prepared by: Kello	er & Ganno	n			•			12-20	
*********	*******	*****	****					Page	
************** GENERAL Name: 20.0 Floor Area Building Weight.: Windows Shaded? Partitions Used.? LIGHTING Overhead Fixture: Lamp Wattage Ballast Mult Task Lighting: PEOPLE Occupancy Activity Level Sensible CTHER LOADS Equipment Misc. Sensible Misc. Latent	Recessed 2580.0 0.00 0.00 0.00 0.00 0.00 0.00 0.00	Office 0 sqft 0 lb/sq N N 0 W 0 W/sqf 5 Peopl	ıft I t e F r t	******* CHEDULE Lightin Task Li People. Equipme Misc. S Misc. I NFILTRA Cooling Heating Typical When Fa LOOR Type Perimet Slab Fl Floor R Insulat	ent Sens Atent: TION On.? er oor Are-Value.	Light Light Light Light Light	s s s s s s s s s s s s s s s s s s s	FM/sqft FM/sqft FM/sqft FM/sqft	****(
WALL Gross Area Exp (sqft)	WALL Type	=====	==== INDOW	====== Shade		INDOW Qty	Shade	Any Doors?	===
S 270.0 E 187.2 W 54.0	2 2 2 2	1 1 1	0 0 0	-	1 1 1	0 0 0	-	N N N	
ROOF Slope Gro	ss Area (sqft)	ROOF Type	SKY) Type	LIGHT Qty					
HOR -	624.0	1	1	0					
No partition data	for this s_1	 pace.				=====		=======	===

Prepared by: Keller HAP v3.06	r & Gannoi	1			•			12-20-94 Page
*************** GENERAL Name: 21. Co Floor Area: Building Weight: Windows Shaded.? Partitions Used.? LIGHTING Overhead Fixture: Lamp Wattage: Ballast Mult: Task Lighting: PEOPLE Occupancy:	106.0 70.0 N Recessed 600.0 1.00 0.00	W W/sqf Peopl	µft I	******** SCHEDULE Lightin Task Li People. Equipme Misc. I NFILTRA Cooling Heating Typical When Fa	ghts.: ent sens atent: TION n On.?	Light: Light: Light: Light: (S S S S S S S S S S S S S S S S S S S	Page : ********* FM/sqft FM/sqft FM/sqft
Activity Level: Sensible: Latent: OTHER LOADS Equipment: Misc. Sensible: Misc. Latent:	ır	Type Perimet Slab Fl Floor R Insulat	er oor Are -Value.	a	•••	10.0 ft 106.0 sqft 0.50 7.00		
WALL Gross Area Exp (sqft)	WALL Type	W Type	INDOW Qty		W Type	INDOW Qty	Shade	Any Doors?
s 100.0	2	1	0		1	0		N
	s Area (sqft)		Туре	LIGHT Qty	====== 		=====	
HOR - 106.0 1 1 0 ==================================								

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***********	***********						
GENERAL	SCHEDULES						
Name: 22. Corridor	Lighting: Lights						
Floor Area: 89.0 sqft	Task Lights.: Lights						
Building Weight.: 70.0 lb/sqft							
Windows Shaded? N	Equipment: Lights						
Partitions Used.? N	Misc. Sens: Lights						
LIGHTING	Misc. Latent: Lights						
Overhead Fixture: Recessed	INFILTRATION						
Lamp Wattage: 340.0 W	Cooling: 0.00 CFM/sqft						
Ballast Mult: 1.00	Heating: 0.00 CFM/sqft						
Task Lighting: 0.00 W/sqft	Typical: 0.00 CFM/sqft						
PEOPLE	When Fan On.?						
Occupancy: 0 People	FLOOR						
Activity Level: Medium Work	Type:Slab On Grade						
Sensible 295.0 BTU/hr	Perimeter 0.0 ft						
Latent 455.0 BTU/hr	Slab Floor Area: 89.0 sqft						
OTHER LOADS	Floor R-Value 0.50						
Equipment: 0.00 W/sqft	Insulation R-value: 7.00						
Misc. Sensible: 0.0 BTU/hr							
Misc. Latent: 0.0 BTU/hr							
No external wall or window data for this space.							
ROOF Slope Gross Area ROOF SI	KYLIGHT						
Exp (deg) (sqft) Type Type	pe Qty						
HOR - 89.0 1	1 0						
No partition data for this space.							

GENERAL Name: 23. Corridor Floor Area: 190.0 sqft Building Weight: 70.0 lb/sqft People: Lights Building Weight: 70.0 lb/sqft People: Lights Windows Shaded.? N Partitions Used.? N Partitions Used.? N Misc. Sens.: Lights LIGHTING Overhead Fixture: Recessed Lamp Wattage: 860.0 W Cooling: 0.00 CFM/sqft Ballast Mult: 1.00 Heating: 0.00 CFM/sqft Task Lighting: 0.00 W/sqft Typical: 0.00 CFM/sqft Typical: 0.00 CFM/sqft Typical: 0.00 CFM/sqft Typical: 0.00 CFM/sqft Type:Slab On Grade Sensible: 295.0 BTU/hr Latent: 455.0 BTU/hr Perimeter: 0.0 ft Slab Floor Area: 190.0 st Floor R-Value: 7.00 No external wall or window data for this space. ROOF Slope Gross Area ROOF SKYLIGHT Exp (deg) (sqft) Type Type Qty HOR - 190.0 1 1 0	Prepa HAP v		Keller	& Ganno	n	511102	. 223		101.					-	0-94 e 1
Name: 23. Corridor Floor Area: 190.0 sqft Task Lights: Lights Building Weight: 70.0 lb/sqft People: Lights Windows Shaded.? N Equipment: Lights Partitions Used.? N Misc. Sens.: Lights LIGHTING Misc. Latent: Lights Overhead Fixture: Recessed INFILTRATION Lamp Wattage: 860.0 W Cooling: 0.00 CFM/sqft Ballast Mult: 1.00 Heating: 0.00 CFM/sqft Task Lighting: 0.00 W/sqft Typical: 0.00 CFM/sqft PEOPLE When Fan On.? N Occupancy: 0 People FLOOR Activity Level.: Medium Work Type:Slab On Grade Sensible: 295.0 BTU/hr Perimeter: 0.0 ft Latent: 455.0 BTU/hr Perimeter: 0.0 ft Latent: 455.0 BTU/hr Slab Floor Area: 190.0 sc Equipment: 0.00 W/sqft Insulation R-value: 7.00 Misc. Sensible: 0.0 BTU/hr Misc. Latent: 0.0 BTU/hr Misc. Latent: 0.0 BTU/hr Misc. Latent: 0.0 BTU/hr Misc. Sensible: 0.0 BTU/hr Misc. S	****	*****	*****	*****	***	****	****	****	***	*****	****	***	******	**	***
Name: 23. Corridor Floor Area: 190.0 sqft Task Lights. Lights Building Weight: 70.0 lb/sqft People: Lights Windows Shaded.? N Equipment: Lights Partitions Used.? N Misc. Sens: Lights LIGHTING Misc. Latent: Lights Overhead Fixture: Recessed INFILTRATION Lamp Wattage: 860.0 W Cooling: 0.00 CFM/sqft Ballast Mult: 1.00 Heating: 0.00 CFM/sqft Task Lighting: 0.00 W/sqft Typical: 0.00 CFM/sqft Task Lighting: 0 People FLOOR Activity Level.: Medium Work Type:Slab On Grade Sensible: 295.0 BTU/hr Perimeter: 0.0 ft Latent: 455.0 BTU/hr Perimeter: 0.0 ft Latent: 455.0 BTU/hr Slab Floor Area: 190.0 sc There Ioads Floor R-Value: 7.00 Misc. Sensible: 0.0 BTU/hr Misc. Latent: 0.0 BTU/hr Misc. Latent: 0.0 BTU/hr Misc. Latent: 0.0 BTU/hr Misc. Latent: 0.0 BTU/hr Misc. Sensible: 0.0 BTU/hr Misc. Sensible: 0.0 BTU/hr Misc. Sensible: 0.0 BTU/hr Misc. Latent: 0.0 BTU/hr Misc. Latent: 0.0 BTU/hr Misc. Latent: 0.0 BTU/hr Misc. Sensible: 0	GENER	AT.						SCHED	ULE	S					
Floor Area: 190.0 sqft			23. Co	rridor						_	Lights				
Building Weight:: 70.0 lb/sqft People: Lights Windows Shaded.? N Misc. Sens.: Lights LightING Misc. Latent: Lights Overhead Fixture: Recessed INFILTRATION Lamp Wattage: 860.0 W Cooling: 0.00 CFM/sqft Ballast Mult: 1.00 Heating: 0.00 CFM/sqft Task Lighting: 0.00 W/sqft Typical: 0.00 CFM/sqft PEOPLE When Fan On.? N Occupancy: 0 People FLOOR Activity Level.: Medium Work Type:Slab On Grade Sensible: 295.0 BTU/hr Perimeter: 0.0 ft Latent: 455.0 BTU/hr Slab Floor Area: 190.0 sc OTHER LOADS Floor R-Value: 7.00 Misc. Sensible.: 0.00 BTU/hr Misc. Latent: 0.0 BTU/hr Misc. Latent: 0.0 BTU/hr Misc. Sensible.: 0.0 BTU/hr Misc. Latent: 0.0 BTU/hr Misc. Sensible.: 0.0 BTU/hr Misc. Sensible.: 0.0 BTU/hr Misc. Sensible.: 0.0 BTU/hr Misc. Sensible.: 0.0 BTU/hr Misc. Latent: 0.0 BTU/hr Misc. Latent: 0.0 BTU/hr Misc. Latent: 0.0 BTU/hr Misc. Latent: 0.0 BTU/hr Misc. Sensible.: 0.0 BTU/hr Misc. Latent: 0.0 BTU/hr Misc. Latent: 0.0 BTU/hr Misc. Sensible.: 0.0 BTU/hr Misc. Latent: 0.0 BTU/hr					n	saft		Task	T.i.	ghts.	Lights				
Windows Shaded? N Equipment: Lights Partitions Used.? N Misc. Sens.: Lights LIGHTING Misc. Latent: Lights Overhead Fixture: Recessed INFILTRATION Lamp Wattage: 860.0 W Cooling: 0.00 CFM/sqft Ballast Mult: 1.00 Heating: 0.00 CFM/sqft Task Lighting: 0.00 W/sqft Typical: 0.00 CFM/sqft PEOPLE When Fan On.? N Occupancy: 0 People FLOOR Activity Level: Medium Work Type:Slab On Grade Sensible: 295.0 BTU/hr Perimeter: 0.0 ft Latent: 455.0 BTU/hr Slab Floor Area: 190.0 sc This control of the sensible of t								Denn		91103	Lights				
Partitions Used.? N Misc. Sens.: Lights LIGHTING Misc. Latent: Lights Overhead Fixture: Recessed INFILTRATION Lamp Wattage: 860.0 W Cooling: 0.00 CFM/sqft Ballast Mult: 1.00 Heating: 0.00 CFM/sqft Task Lighting: 0.00 W/sqft Typical: 0.00 CFM/sqft PEOPLE When Fan On.? N Occupancy: 0 People FLOOR Activity Level.: Medium Work Type:Slab On Grade Sensible: 295.0 BTU/hr Perimeter: 0.0 ft Latent: 455.0 BTU/hr Slab Floor Area: 190.0 sc OTHER LOADS Floor R-Value: 0.50 Equipment: 0.00 W/sqft Insulation R-value: 7.00 Misc. Sensible.: 0.0 BTU/hr Misc. Latent: 0.0 BTU/hr Misc. Latent: 0.0 BTU/hr Mo external wall or window data for this space. ROOF Slope Gross Area ROOF SKYLIGHT Exp (deg) (sqft) Type Type Qty						10/54									
LIGHTING Overhead Fixture: Recessed Latent: Lights Overhead Fixture: Recessed Lamp Wattage: 860.0 W Ballast Mult: 1.00 Ballast Mult: 1.00 Heating: 0.00 CFM/sqft Typical: 0.00 CFM/sqft Typical: 0.00 CFM/sqft Typical: 0.00 CFM/sqft When Fan On.? N Occupancy: 0 People Activity Level.: Medium Work Sensible: 295.0 BTU/hr Latent: 455.0 BTU/hr OTHER LOADS Equipment: 0.00 W/sqft Misc. Latent: 0.00 BTU/hr Misc. Sensible.: 0.0 BTU/hr Misc. Latent: 0.0 BTU/hr Type Type Qty								Micc	DWG.	one .	Lights				
Overhead Fixture: Recessed			beu		14										
Lamp Wattage: 860.0 W Cooling: 0.00 CFM/sqft Ballast Mult: 1.00			zturo.	Pogoggod							Highes				
Ballast Mult: 1.00 Heating: 0.00 CFM/sqft Task Lighting: 0.00 W/sqft Typical: 0.00 CFM/sqft PEOPLE When Fan On.? N Occupancy: 0 People FLOOR Activity Level Medium Work Type:Slab On Grade Sensible: 295.0 BTU/hr Perimeter: 0.0 ft Latent: 455.0 BTU/hr Slab Floor Area: 190.0 sc Floor R-Value: 0.50 Equipment: 0.0 BTU/hr Misc. Sensible: 0.0 BTU/hr Misc. Latent: 0.0 BTU/hr No external wall or window data for this space. ROOF Slope Gross Area ROOF SKYLIGHT Exp (deg) (sqft) Type Type Qty						T.7					•	~~	OFW / www.f.h.		
Task Lighting: 0.00 W/sqft Typical: 0.00 CFM/sqft PEOPLE When Fan On.? N Occupancy: 0 People FLOOR Activity Level: Medium Work Type:Slab On Grade Sensible: 295.0 BTU/hr Perimeter: 0.0 ft Latent: 455.0 BTU/hr Slab Floor Area: 190.0 sc OTHER LOADS Floor R-Value: 0.50 Equipment: 0.00 W/sqft Insulation R-value: 7.00 Misc. Sensible: 0.0 BTU/hr Misc. Latent: 0.0 BTU/hr Misc. Latent: 0.5 SKYLIGHT Exp (deg) (sqft) Type Type Qty	Lamp	wallage	= · · · · ·	860.		W		COOT	ing	• • • • • •					
PEOPLE Occupancy: 0 People FLOOR Activity Level.: Medium Work Type:Slab On Grade Sensible: 295.0 BTU/hr Perimeter: 0.0 ft Latent: 455.0 BTU/hr Slab Floor Area: 190.0 sc OTHER LOADS Floor R-Value: 0.50 Equipment: 0.00 W/sqft Insulation R-value: 7.00 Misc. Sensible: 0.0 BTU/hr Misc. Latent: 0.0 BTU/hr Misc. Latent: 0.0 BTU/hr Misc. Sensible: 0.0 BTU/hr Misc. Latent: 0.0 BTU/hr SKYLIGHT Exp (deg) (sqft) Type Type Qty						T.T /	_	Heat.	Tuď	• • • • • •					
Occupancy: 0 People FLOOR Activity Level.: Medium Work Type:Slab On Grade Sensible: 295.0 BTU/hr Perimeter: 0.0 ft Latent: 455.0 BTU/hr Slab Floor Area: 190.0 sc OTHER LOADS Floor R-Value: 0.50 Equipment: 0.00 W/sqft Insulation R-value: 7.00 Misc. Sensible: 0.0 BTU/hr Misc. Latent: 0.0 BTU/hr Misc. Latent: 0.0 BTU/hr Sometime of the space of the space of the space. ROOF Slope Gross Area ROOF SKYLIGHT Exp (deg) (sqft) Type Type Qty			1g:	0.0	U	w/sqI	C				0.		CFM/sqrt		
Activity Level: Medium Work Sensible: 295.0 BTU/hr Perimeter: 0.0 ft Latent: 455.0 BTU/hr Slab Floor Area: 190.0 sc OTHER LOADS Equipment: 0.00 W/sqft Insulation R-value: 7.00 Misc. Sensible: 0.0 BTU/hr Misc. Latent: 0.0 BTU/hr No external wall or window data for this space. ROOF Slope Gross Area ROOF SKYLIGHT Exp (deg) (sqft) Type Type Qty					_					n on.?		N			
Sensible: 295.0 BTU/hr Perimeter	occu	pancy	•••••		U	Leobre	е.					_	_		
Latent: 455.0 BTU/hr Slab Floor Area: 190.0 sc OTHER LOADS Floor R-Value: 0.50 Equipment: 0.00 W/sqft Insulation R-value: 7.00 Misc. Sensible: 0.0 BTU/hr Misc. Latent: 0.0 BTU/hr No external wall or window data for this space. ROOF Slope Gross Area ROOF SKYLIGHT Exp (deg) (sqft) Type Type Qty								Туре	• • •	: :	Slab On	Gra			
OTHER LOADS Floor R-Value: 0.50 Equipment: 0.00 W/sqft Insulation R-value: 7.00 Misc. Sensible: 0.0 BTU/hr Misc. Latent: 0.0 BTU/hr No external wall or window data for this space. ROOF Slope Gross Area ROOF SKYLIGHT Exp (deg) (sqft) Type Type Qty															
Equipment: 0.00 W/sqft Insulation R-value: 7.00 Misc. Sensible: 0.0 BTU/hr Misc. Latent: 0.0 BTU/hr No external wall or window data for this space. ROOF Slope Gross Area ROOF SKYLIGHT Exp (deg) (sqft) Type Type Qty			:	455.	0	BTU/h:	r						190.	0 8	sqft
Misc. Sensible: 0.0 BTU/hr Misc. Latent: 0.0 BTU/hr No external wall or window data for this space. ROOF Slope Gross Area ROOF SKYLIGHT Exp (deg) (sqft) Type Type Qty							•						0.5	0	
Misc. Latent: 0.0 BTU/hr No external wall or window data for this space. ROOF Slope Gross Area ROOF SKYLIGHT Exp (deg) (sqft) Type Type Qty								Insu:	lati	ion R-v	zalue	.:	7.0	0	
No external wall or window data for this space. ROOF Slope Gross Area ROOF SKYLIGHT Exp (deg) (sqft) Type Type Qty	Misc	. Sensik	ole:												
ROOF Slope Gross Area ROOF SKYLIGHT Exp (deg) (sqft) Type Type Qty	Misc	. Latent	:	0.	0	BTU/h	r								
Exp (deg) (sqft) Type Type Qty	No ex	ternal w	all or	window	== da	ta for	r th	===== is spa	ace.	======	*=====				===
Exp (deg) (sqft) Type Type Qty	=====	=======	=====		==:	=====	====					===			===
					1 '				- 1						
HOR - 190.0 1 1 0	Exp	(deg)		(sqit)	'	Туре	Туре	e Qt	EY						
	HOR	_		190.0	 	·1		L	0						
No partition data for this space.	No pai	tition	data f	or this	== spa	===== ace.									===

Prepared by: Keller & Gannor HAP v3.06	·	12-20-94 Page 1
***********	*******	*********
GENERAL	SCHEDULES	
Name: 24,27. Corridor		: Lights
Floor Area: 349.0		
	lb/sqft People	
Windows Shaded?	Equipment	
Partitions Used.?	Misc. Sens	
LIGHTING	Misc. Latent	
Overhead Fixture: Recessed	INFILTRATION	· Lighted
Lamp Wattage: 230.0		: 0.00 CFM/sqft
Ballast Mult: 1.00	Heating	: 0.00 CFM/sqft
	W/sqft Typical	
PEOPLE	When Fan On.	
Occupancy: 0	People FLOOR	•
Activity Level: Office Wo		:Slab On Grade
Sensible 245.0		9.9 ft
	BTU/hr Slab Floor A	
OTHER LOADS	Floor R-Valu	
	W/sqft Insulation R	
	BTU/hr	-varue /.00
	BTU/hr	
=======================================	510/III ==================================	
WALL Gross Area WALL	WINDOW	WINDOW Any
Exp (sqft) Type		··
(pdr.c) tlbc	Type Qty Shade Type	e Qty Shade Doors?
N 79.2 2	1 0 - 1	о – и
ROOF Slope Gross Area	ROOF SKYLIGHT	
Exp (deg) (sqft)	Type Type Qty	
HOR - 349.0	1 1 0	
No partition data for this sp	ace.	
======================================		

Prepared by: Kelle		DIACL						12-20 Page	
**************************************	Free-Hang 770.0 1.00 0.00 0ffice Won 245.0 205.0	sqft lb/sqf ing W W/sqft People	s I	****** CHEDULE Lighting Task Lighting People. Equipmen Misc. So Misc. Lighting Cooling Heating Typical When Far LOOR Type Perimeto Slab Floor Floor Insulat:	ghts.: ghts.: nt: ens: atent: TION On.?	Light: Light: Light: Light: Light: Light:	S S S S S S S S S S S S S S S S S S S	M/sqft M/sqft	
WALL Gross Area Exp (sqft)	WALL Type		NDOW Qty	Shade	Type	INDOW Qty	Shade	Any Doors?	
S 274.6 W 554.4	3 3	1	0	_	1 1	0 0	-	N N	
ROOF Slope Gro	ss Area (sqft)	ROOF Type		LIGHT Qty					
HOR -	666.0	1	1	0					
PARTITION LOADS	т <u>у</u>	pe 1			T	ype 2			
Type	: 2 : 0 : Max:	74.6 s		r/sqft/F	Ceil	Õ.O	F F	/sqft/F	

Prepared by: Keller & G	annon		*****	12-20-94 Page 1
Building Weight.: Windows Shaded? Partitions Used.? LIGHTING Overhead Fixture: Free Lamp Wattage: Ballast Mult: Task Lighting: PEOPLE Occupancy: Activity Level: Office	756.0 sqft 70.0 lb/sqft N N -Hanging 020.0 W 1.00 0.00 W/sqft 0 People	********** SCHEDULES Lighting Task Lights People Equipment Misc. Sens. Misc. Laten INFILTRATION Cooling Heating Typical When Fan On FLOOR Type Perimeter Slab Floor Floor R-Valuenting	.: Lights .: Lights .: Lights t: Lights 0.00 0.00 0.00 1.000	**************************************
WALL Gross Area WAI Exp (sqft) Typ			WINDOW De Qty Sha	Any de Doors?
N 336.0	3 1 (· - :	0	– N
ROOF Slope Gross Are Exp (deg) (sqft		YLIGHT De Qty		
HOR - 864.	0 1	1 0		=======================================
No partition data for the	is space.			

Prepared by: I			****	*****	****		+++++	Pag	0-94 je 1
*********** GENERAL Name: Floor Area Building Weic Windows Shade Partitions Us LIGHTING Overhead Fixt Lamp Wattage. Ballast Mult. Task Lighting PEOPLE Occupancy Activity Leve Sensible Latent OTHER LOADS Equipment Misc. Sensibl Misc. Latent.	117-3: 1. Me 294 pht.: 7 ed? sed.? cure: Free-H: 482: 1: 0 cl: Office: 24!: 7 e: 7	ch Room 4.0 sqft 0.0 lb/sq: N Y anging 0.0 W .00 .00 W/sqft	ft I II II E FI C F F F F F F F F F F F F	CHEDULE Lightin Task Li	gghts.: ghts.: ens.: ens.: atent: TION: n On.? er	117-3 117-3 117-3 Contin Light: Light:	Schedu Schedu Schedu nuous s 0.00 CF 0.00 CF N n Grade	********* le le le M/sqft M/sqft	ft
WALL Gross Ar Exp (sqf	========= ea WALL	 IW	ENDOW	Shade	W Type	INDOW Qty	Shade	Any Doors?	====
S 970 E 189	.	1 1	0 0	-	1	0	-	N N	
ROOF Slope Exp (deg)	Gross Area (sqft)	ROOF Type		IGHT Qty					
S 5	2944.0	2	1	0					
PARTITION LOAD	S	Type 1			T	 ype 2			
Type	Temp Temp Temp	rtition 1212.0 s 0.541 B 85.0 F 97.0 F 45.0 F 7.0 F	TU/hr	/sqft/F		ition 661.0 0.212 75.0 97.0 68.0 7.0	BTU/hr/ F F F	/sqft/F	

Prepared by: Keller & Gannon HAP v3.06		12-20-94
*********	***********	Page 1
GENERAL	SCHEDULES	********
Name: 117-3: 2. Contr		ıle
Floor Area: 710.0	sqft Task Lights.: 117-3 Schedu	ile
Building Weight.: 70.0 Windows Shaded? N	lb/sqft People: 117-3 Schedu	
Windows Shaded? N	Equipment: Continuous	
Partitions Used.? Y	Misc. Sens: Lights	
LIGHTING	Misc. Latent: Lights	
Overhead Fixture: Recessed	INFILTRATION	
Lamp Wattage: 2920.0	W Cooling: 0.00 CF	M/saft
Ballast Mult: 1.00	Heating . 0 00 cm	M/saft
Task Lighting: 0.00	W/sqft Typical: 0.00 CF	
PEOPLE	When Fan On.?	, bqr c
Occupancy 3	People FLOOR	
Activity Level: Sedentary	Work Type • Clab On Crade	
Sensible 280.0	BTU/hr Perimeter:	0.0 ft
Sensible	BTU/hr Slab Floor Area	710.0 sqft
OTHER LOADS	Floor R-Value •	0.50
Equipment 3.00	W/sqft Insulation R-value:	7.00
Misc. Sensible: 0.0	BTU/hr	7.00
Misc. Latent: 0.0	BTU/hr	
	· 	========
No external wall or window da	ta for this space.	
	ROOF SKYLIGHT	
Exp (deg) (sqft)	Type Type Qty	
S 5 2944.0	4 1 0	
PARTITION LOADS Ty	pe 1 Type 2	
Type Parti	rion Doubition	
Area	tion Partition	
Area	91.2 sqft 0.0 sqft	/
Maximum Space Temp:	.212 BTU/hr/sqft/F	sqrt/r
Outside Air Temp @ Max:		
Minimum Space Temp:	5.0 F 68.0 F	
Outside Air Temp @ Min:	7.0 F 7.0 F	

HAP v	red by: Kelle			L DED					Pag	-
	*****	*****	****				****	*****	****	****
GENER					SCHEDULE				_	
	117-3									
Floo	r Area:	3860.0			Task Li					
Buil	ding Weight.:	70.0	lb/s	qft	People.				le	
Wind	ows Shaded?	, I	1		Equipme	nt:	Conti	nuous		
Part	itions Used.?	7	?		Misc. S	ens:	Light	S		
LIGHT	ING				Misc. L	atent:	Light	s		
	head Fixture:	Free-Hand	ring	I	NFILTRA		-			
	Wattage:	11000.0			Cooling	:		0.00 CF	M/saft	
	ast Mult:				Heating			0.00 CF		
	Lighting:		W/sq:	ft.	Typical			30.0 CF		
PEOPL		0.00	,, bq.		When Far		•	Y		
	pancy:	٥	Peop	ם בו	LOOR	011		-		
Not i	vity Level:	Modium Wo	reop.	16 1	Type	• •	slah O	n Grade		
ACCI	AICA TEAGI	295.0	ידע. דער	h~	Perimet				50.0	£+
	ible									
	nt:	455.0	PIO/1		Slab Flo				3860.0	sdrr
	LOADS	5 00	7.7 /		Floor R				0.50	
	pment		W/sq:		Insulat	ion K-	alue.	:	7.00	
	. Sensible:		BTU/I							
	. Latent:		BTU/1	nr					,	
WALL	======================================	WALL		WINDOW		 ! τ	VINDOW		l Any	
		1	-			1		Chada	Any)
Exp	(sqft)	Type	Type	Qty	Shade	Type	Qty	Shade 	Doors?	
E	292.5	9	1	0	-	1	0	-	N	
W	292.5	9	1	0	-	1	0	_	N	
			=====	-====			.=====		======	====
ROOF		ss Area	ROOF		LIGHT					
Exp	(deg)	(sqft)	Туре	Type	Qty					
HOR	- 	3860.0	3	1	0	<u> </u>				
										===
PARTI	rion Loads		ype 1			 	ype 2			
Type.		: Part	ition			Part	ition			
			606.1	saft				sqft		
	le				r/sqft/H	7			/saft/F	
	ım Space Temp		85.0		-,/1	•	75.0		-3-0/1	
	de Air Temp 0		97.0				97.0			
	im Space Temp.		45.0				68.0			
	lm space remp. le Air Temp 0		7.0				7.0			
Oursit	_	MTII:					7.0	r		

	ared by: Kel v3.06	ler & Ganno	n						12-20-	_
	*****	******	****	*****	******				Page	1
GENE		_		5	CHEDULE	S				***
Name	••••••••••• 117·			2	Lightin	ıg:	117-3	Schedu	ıle	
	or Area		0 sqft		Task Li	ghts.:	117-3	Schedu	ıle	
	lding Weight		0 lb/s	qft	People.	• • • • • •	117-3	Schedu	ıle	
	lows Shaded.		N		Equipme	nt:	Conti	nuous		
	itions Used.	.?	Y		Misc. S					
LIGHT					Misc. L	atent:	Light	s		
	head Fixture			I	NFILTRA		-			
	Wattage		O W		Cooling	:		0.00 CF	M/saft	
	ast Mult		-		Heating			0.00 CF	M/saft	
Task	Lighting	: 0.0	0 W/sqt		Typicaĺ			82.5 CF		
PEOPL	Æ				When Fa	n On.?		Y		
0ccu	pancy	:	8 Peopl		LOOR			_		
	vity Level		ork		Type	: S	lab O	n Grade		
Sens	ible	: 295.	O BTU/h		Perimet				50.0 ft	
	nt		O BTU/h		Slab Fl					
	LOADS		0 210/1		Floor R				3860.0 sq	T C
	pment	• 5.0	0 W/sqf	·+	Insulat				0.50	
Misc	. Sensible		O BTU/h		Insulat.	TOIL K-V	arue.	• • • •	7.00	
Misc	. Latent		O BTU/h							
=====	==========			:=====			·			
	Gross Area	WALL		INDOW		W	INDOW		Any	
Exp	(sqft)	Type	Туре	Qty	Shade	Type	Qty	Shade	Doors?	
E	292.5	9	1	0		1 1	0		N	
W	292.5	9	1	0	-	1	Ŏ	_	N	
ROOF			======	=====				======		==
		oss Area	ROOF		LIGHT					4
Exp	(deg)	(sqft)	Type	Type	Qty					4
HOR		3860.0	3	1	0					
PARTI'	FION LOADS	7	ype 1			T)	/pe 2			==
Type.	• • • • • • • • • • •	: Part	ition			Parti	tion			
Area.	• • • • • • • • • • • • •	:	606.1	saft		Far C		sqft		
	ıe				r/sqft/F	·			caft /P	
			J. J.T.		- / 2dr c/ t			BTU/hr/	odrr/t	
MOVIN		0 :	85.0	Η'			75 C	₽		
	ım Space Tem		85.0 97.0				75.0			
Outsid	um Space Temp de Air Temp	Max:	97.0	F			97.0	F		
Outsic Minim	ım Space Tem	Max:		F F				F F		

HAP v	red by: Kelle 73.06		1						Pag	
****	*****	****	*****		*******		*****	*****	*****	****
GENER	AL 2: 117-3	• 4. Inrt	Sta BL				117-3	Schedu	le .	
	r Area:	1940.0			Task Li					
	ding Weight.:		lb/sq:		People.					
	lows Shaded?				Equipme	nt:	Conti	nuous		
Part	itions Used.?	7			Misc. S					
LIGHT					Misc. L		Light	S		
	head Fixture:			_	NFILTRA'				75.4 C+	
	Wattage:				Cooling			0.00 CF		
	ast Mult:	1.00			Heating			0.00 CF		
Task PEOPL	Lighting:	0.00	W/sqft		Typical When Fa		3.	30.0 CF	I'I	
	pancy:	2	People		When rai			1		
Acti	vity Level:				Type	: 9	Slab O	n Grade		
Sens	ible	525.0	BTU/hi		Perimet				96.5	ft
	nt:	925.0			Slab Fl				1940.0	sqft
	LOADS				Floor R	-Value.		:	0.50	
	pment:		W/sqft		Insulat:	ion R-v	alue.	:	7.00	
	. Sensible:		BTU/hr							
	. Latent:		BTU/hr							
WALL	Gross Area	WALL		NDOW		<u> </u>	VINDOW		Any	
Exp	(sqft)	Туре	Type	Qty	Shade	Туре	Qty	Shade	Doors?	
s	827.8	6	1	0		1	0	_	N	
E	428.1	6	1	0	-	1	0	-	N	
ROOF	Slope Gros	ss Area	ROOF	SKY	LIGHT					
Exp	(deg)	(sqft)		Type						
s 	· 5	1940.0	2	1	0					
PARTI	TION LOADS	T	 ype 1			T	ype 2			
		: Part	ition	٥.		Part	ition			
			428.1 s		. / £± /T	7		sqft	laaft ID	
	le		0.595 B 85.0 F		r/sqft/I	:	75.0		sdrc\r	
	um Space Temp. de Air Temp 0		97.0 F				97.0			
	im Space Temp.		45.0 F				68.0			
	de Air Temp 0		7.0 F				7.0			
										====

Preparation Preparation	ared by: K v3.06	eller	c & Ganno	on			•			_	20-94
***	*****	****	*****	****	*****	*****			*****	Pa	T
GENE						SCHEDULE				****	*****
Name	···· 1	17-3:	4. Inrt	Sta F	່າ			117			
Floo	or Area	•		0 sqft		maght T	19	11/	Schedu	тте	
	lding Weig			0 lb/s		Task III	ignes.:	11/-:	Schedu	тīе	
Wind	lows Shade	4 2			dir	People.	• • • • • •	117-3	Schedu	ıle	
Part	citions Use	a		N Y		Equipme	nt:	Cont	inuous		
LIGHT		eu.:		I		Misc. S	ens:	Light	s		
			F		_	Misc. I	atent:	Light	S		
Tame	head Fixt	ure:			1	NFILTRA					
Dall I	Wattage.	• • • •	2750.			Cooling	· • • • • • • • • • • • • • • • • • • •		0.00 CF	M/saft	
DG T.	ast Mult.	• • • •	1.0	-		Heating	:		0.00 CF	M/saft	
	$_{\tt Lighting}$	• • • •	0.0	0 W/sq		Typical	:		82.5 CF		
PEOPI						When Fa	n On.?		Y		
occu	pancy	:		2 Peop	le F	LOOR			_		
Acti	vity Level	L:	Heavy Wo	rk -		Type		Slab O	n Grade	•	
Sens	ible	:		O BTU/	hr	Perimet	er	JIUD C	ii Grade		£L.
Late	nt	:		O BTU/		Slab Fl	OOF Are	• • • • •	• • • •	96.5	
OTHER	LOADS	•				Floor R	-Malue	· a · · · ·	• • • •	1940.0	sqit
Equi	pment	:	3.0	0 W/sq:	f+	Insulat	varue.	70] 110	• • • •	0.50	
Misc	. Sensible	2:	0.	0 BTU/1	hr	Insulat	TOIL K-V	alue.	• • • •	7.00	
Misc	. Latent	:	0	0 BTU/1	72						
=====		====	======	======		======	=====	====		======	====
WALL			WALL	1	WINDOW		i w	INDOW		Any	
Exp	(sqft	:)	Type	Type	Qty	Shade	Type		Shade	Doors?	
S E	827.		6	1	0	-	1	0	_	l N	
E	428.	1	6	1	0	-	1	0	_	N	
ROOF	Slope	E====	area	POOF		======		=====	======		
Exp	(deg)			ROOF		LIGHT					_
		'	(sqft)	Type	Type	Qty					4
S	5	1	940.0	2	1	0					•
			1	=====	<u>_</u>	V =======	=====	====:			
PARTIT	TION LOADS		I	Type 1			T	ype 2			
Type	• • • • • • • • • •		. Dart								
Area	• • • • • • • • •	• • • • •					Part	ition			
U-val:	le	• • • • •		428.1			_		sqft		
Mayimi	m Space me	· · · · ·	•••	0.595	PIO/DI	/sqft/F	. (0.212	BTU/hr/	sqft/F	
Outeid	m Space Te	= mp • •	· • •	85.0				75.0	F	- •	
Minimu	le Air Temp	i e w	axi	97.0				97.0	F		
Onteid	m Space Te	:աp	· · ·	45.0				68.0			
=====	e Air Temp	9 M		7.0 =====	-			7.0	F		

		Kelle	r & Ganno	n	D DESC						20-94
										Pa	ge 1
GENER Name Floo Buil Wind Part LIGHT Over Lamp Ball Task PEOPL Occu Acti Sens Late OTHER	******** RAL Or Area. Iding Weidle Shade Shade Shade Shade Shade Six Multage ast Multage ast Multage Interest Shade Sh	117-3 ght.: ed? sed.? ture:	70. Free-Han 1500. 1.0 0.0 Heavy Wo: 525. 925.	O sqft O lb/so N ging O W O O W/sqf 1 Peopl rk O BTU/h O BTU/h	Ift It Ie F	******* SCHEDULE Lightin Task Li People. Equipme Misc. S Misc. L NFILTRA Cooling Heating Typical When Fa LOOR Type Perimet Slab Fl Floor R Insulat	ghts.: ghts.: ens.: ens.: atent: TION n On.? er oor Are	117-3 117-3 Conti Light Light	Sched Sched nuous s 0.00 C 0.00 C N n Grad	ule ule FM/sqft FM/sqft FM/sqft	**** ft
	. Sensible. Latent.			O BTU/h O BTU/h							
===== WALL Exp	Gross An (sqi		WALL Type	W Type	VINDOW Qty		Type	VINDOW Qty	Shade	Any Doors	?
N W	299 408		10 9	1 1	0 0		1 1	0 0		N N	
ROOF Exp	Slope (deg)	Gros	ss Area (sqft)	ROOF Type	SKY Type	LIGHT Qty					
N	5		630.0	2	1	0					
No pa	rtition d	lata f	or this s	space.							

HAP v3.06 Pa	-20-94 age 1
*****************	*****
GENERAL SCHEDULES	
Name: 117-3: 6. Cell 2 Lighting: 117-3 Schedule	
Floor Area: 630.0 sqft Task Lights:: 117-3 Schedule	
Building Weight.: 70.0 lb/sqft People: 117-3 Schedule	
Windows Shaded? N Equipment: Continuous	
Partitions Used.? N Misc. Sens.: Lights	
LIGHTING Misc. Latent: Lights	
Overhead Fixture: Free-Hanging INFILTRATION	
Lamp Wattage: 1500.0 W Cooling: 0.00 CFM/sqft	
Ballast Mult: 1.00 Heating: 0.00 CFM/sqft	
Task Lighting: 0.00 W/sqft Typical: 0.00 CFM/sqft	
PEOPLE When Fan On.?	
Occupancy: 1 People FLOOR	
Activity Level: Heavy Work Type:Slab On Grade	
Sensible: 525.0 BTU/hr Perimeter 23.0	f+
Tabaab aa aa aa aa aa aa aa aa aa aa aa a	sqft
OTHER LOADS Floor R-Value 0.50	
Equipment: 5.00 W/sqft Insulation R-value: 7.00	
Misc. Sensible: 0.0 BTU/hr	
Misc. Latent: 0.0 BTU/hr	
=======================================	
WALL Gross Area WALL WINDOW WINDOW Any	====
Time Window Mily	2
Exp (sqit) Type Type Qty Shade Type Qty Shade Doors	<i>:</i>
N 299.0 10 1 0 - 1 0 - N	
ROOF Slope Gross Area ROOF SKYLIGHT	
There (down)	
Exp (deg) (sqft) Type Type Qty	
N 5 630.0 2 1 0	(
No partition data for this space.	====
	====

HAP			r & Ganno	n						12-2 Pag	20-94 ge 1
GENER Name Floo Buil Wind Part LIGHT Over Lamp Ball Task PEOPL OCCU Acti Sens Late OTHER Equi Misc	RAL or Area Iding Wei lows Shad citions U TING Thead Fix to Wattage ast Mult Lightin E pancy vity Lev	117-3 ght.: ed? sed.? ture: g el:	70. Free-Han 1500. 1.0 0.0 Heavy Wo. 525. 925.0	O sqft O lb/so N ging O W O O W/sqi 1 Peopl rk O BTU/h	qft ft nr nr ft nr	SCHEDULE Lightin Task Li People. Equipme Misc. S Misc. L INFILTRA Cooling Heating Typical When Fa LOOR Type Perimet Slab Fl Floor R Insulat	ghts.: nt: ens: atent: TION: n On.? er oor Are	117-3 117-3 Conti Light Light	Schedu Schedu nuous s s 0.00 CF 0.00 CF N n Grade :	nle nle M/sqft M/sqft M/sqft	
WALL Exp	Gross A		WALL Type	Type	VINDOW Qty		Type	VINDOW Qty	Shade	Any Doors?	
N	29	9.0	10	1	0		1	0		N	
ROOF Exp	Slope (deg)	Gros	s Area (sqft)	ROOF Type	SKY Type	LIGHT Qty					
N	5		630.0	2	1	0					
No pa	rtition o	data f	or this s	pace.			2				_===

Prepared by: Keller & Gann HAP v3.06			12-20-94 Page 1
GENERAL Name: 117-3: 8. Cel Floor Area: 630 Building Weight.: 70 Windows Shaded? Partitions Used.? LIGHTING Overhead Fixture: Free-Ha Lamp Wattage: 1500 Ballast Mult: 1. Task Lighting: 0. PEOPLE Occupancy: Activity Level: Heavy Westivity Level: Heavy Westivity Level: 925 OTHER LOADS Equipment: 5.00 Misc. Sensible: 0	SCHED 1 4 Ligh .0 sqft Task .0 lb/sqft Peop N Equi N Misc Misc nging INFIL .0 W Cool 00 Heat 00 W/sqft Typi When 1 People FLOOR ork Type .0 BTU/hr Peris	ting: 117-3 Scheolights: 117-3 Scheolights: 117-3 Scheolights: 117-3 Scheolights: 117-3 Scheolights: Continuous Sens.: Lights TRATION ing: 0.00 Continuous O.00 Continuo	**************************************
WALL Gross Area WALL Exp (sqft) Type	WINDOW Type Qty Shace	WINDOW de Type Qty Shade	Any Doors?
N 299.0 10	1 0 -	- 1 0 -	и
ROOF Slope Gross Area Exp (deg) (sqft)	ROOF SKYLIGH Type Type Qt		
N 5 630.0	2 1	0	(
No partition data for this	space.		

HAP	ared by: Kell v3.06							. 4 4 4 4 4 4	12 - 2 Pag	0-94 je 1
GENEINAME Floo Buil Wince Part LIGHT Over Lame Ball Task PEOPI Occu Acti Sens Late OTHER Equi Misc	RAL or Area lding Weight. lows Shaded titions Used. TING chead Fixture Wattage Lighting	3: 9. Cell 242. 70. ? ? : Free-Hand 500. 1.00 1.00 1.00 2. Heavy Wood 525.0 3.00 0.00	O sqft O lb/sq N Ging O W O W/sqf I Peopl	aft le I	CHEDULE Lightin Task Li People. Equipme Misc. S Misc. I INFILTRA Cooling Heating Typical When Fa FLOOR Type Perimet Slab Fl Floor R Insulat	gghts.:ens atent: TION n On.? er oor Are	117-3 117-3 Conti Light Light	Schedu Schedu nuous s 0.00 CF 0.00 CF N n Grade	nle nle M/sqft M/sqft M/sqft	
WALL Exp	Gross Area (sqft)	WALL Type	W Type	INDOW Qty	i Shade	Type	VINDOW Qty	Shade	Any Doors?	
N	217.8	10	1	0		1	0		N	
ROOF Exp	Slope Gr (deg)	oss Area (sqft)	ROOF Type	SKY Type	LIGHT Qty					
N	5	242.0	2	1	0					
No pa	rtition data	for this s	pace.							

Prepared by: Keller HAP v3.06	& Ganno	n			•			12-20-94 Page 1
HAP v3.06 ******************* GENERAL Name: 117-3: Floor Area: Building Weight.: Windows Shaded? Partitions Used.? LIGHTING Overhead Fixture: F Lamp Wattage: Ballast Mult: Task Lighting: PEOPLE Occupancy: Activity Level: H Sensible: Latent	240.0 70.0 70.0 1 1 500.0 1.00 0.00	O sqft O lb/sq N Jing O W O W/sqf O Peopl O BTU/h	ıft I t e F r	******** CHEDULE Lightin Task Li People. Equipme Misc. S Misc. L NFILTRA Cooling Heating Typical When Fa LOOR Type Perimet Slab Floor R	gghts.: entens atent: TION n On.? er	117-3 117-3 Conti Light Light	Schedu Schedu nuous s s 0.00 CF 0.00 CF N n Grade	**************************************
Equipment Misc. Sensible Misc. Latent	0.0	W/sqf BTU/h BTU/h	t r	Insulat	ion R-v	alue.	• • • •	7.00
WALL Gross Area Exp (sqft)	WALL Type	W Type	INDOW Qty	Shade	W Type	INDOW Qty	Shade	Any Doors?
N 214.5 E 195.8	10	1	0 0	- -	1 1	0 0	_	N N
ROOF Slope Gross Exp (deg) (Area sqft)	ROOF Type	SKYI Type	LIGHT Qty		====		=======================================
	240.0	2	1	0				
No partition data for	this s	pace. ======			======			

K-48

Prepared by: Kello HAP v3.06	er & Ganno	n ******	******	******	*****	12-20-94 Page 1
GENERAL Name: 117-3 Floor Area Building Weight.: Windows Shaded Partitions Used LIGHTING Overhead Fixture: Lamp Wattage: Ballast Mult: Task Lighting: PEOPLE Occupancy Activity Level Sensible Latent OTHER LOADS Equipment Misc. Sensible Misc. Latent	Free-Han 1500. 1.0 0.0 Heavy Wo: 525. 925.	0 sqft 0 lb/sqft N ging 0 W 0 W/sqft 3 People rk	Task Li People. Equipme Misc. S Misc. I INFILTRA Cooling Heating Typical When Fa FLOOR Type Perimet Slab Fl Floor R	g: 117- ghts.: 117: 117- ent: Cont ens: Ligh atent: Ligh TION	3 Schedu 3 Schedu inuous ts 0.00 CF 0.00 CF N On Grade	lle lle M/sqft M/sqft M/sqft
WALL Gross Area Exp (sqft)	WALL Type	WINI Type Qt	DOW ty Shade	WINDOW Type Qty	-	Any Doors?
E 216.8] 3	1	0 -	1 0	-	N
ROOF Slope Gro Exp (deg)	ss Area (sqft)		SKYLIGHT /pe Qty			
N 5	500.0	2	1 0			
No partition data	for this s	 pace.				

HAP v									Pag	20-94 ge 1
****	*********	******	****	****	*****	****	****	*****	****	 *****
GENEF				5	CHEDULE	s				•
Name	117- 3	: 12. Supe	ervsr (Offc	Lightin	a:	117-3	Schedu	ıle	
F.TOC	or Area:	412.0	sqft		Task Li	ghts.:	117-3	Schedu	ile	
Buil	.ding Weight.:	70.0			People.					
Wind	lows Shaded?	, I		1	Equipme					
	itions Used.?				Misc. S				1.10	
LIGHT	ING				Misc. L					
Over	head Fixture:	Recessed			NFILTRA		Digiic			
Lamp	Wattage:	1550.0	W		Cooling			0.00 CF	M/caft	
Ball	ast Mult:	1.00			Heating			0.00 CF		
	Lighting:		W/sqf		Typical			0.00 CF	M/Sqrt	
PEOPL		0.00	, 541		When Fa			0.00 CF	m/sqrt	
	pancy:	Λ	Peop]		LOOR	ii Oii. :		N		
Acti	vity Level	Sedentary	Mork Teopi				11-b 0	a a		
Sens	ible	280 0	BUIL /	.~	Type	••••	STAD U	n Grade		
Late	nt		BTU/h		Perimet	er	• • • • •	• • • •	40.8	
OTHER	LOADS	270.0	B10/1	ΙT	Slab Floor	oor Are	ea	• • • •	412.0	sqft
	pment:	1 00	W/acf	: .	Floor R	-value.		• • • •	0.50	
Misc	Sensible:		W/sqf		Insulat	tou K-A	ralue.	• • • •	7.00	
	. Latent:		BTU/h BTU/h							
	· Datent		B1U/1	IT.			•			
WALL	Gross Area	WALL		INDOW		 	TNDOW			====
Ехр	(sqft)	Type	Type				INDOW		Any	
		13PC			Silade	Туре	Qty	Shade	Doors?	
S	178.4	2	1	0	_	1	0		l N	
W -	148.0	2	ī	ŏ	-	ī	ő	_	N	
=====		 =======		=====	======		=====		,	
ROOF	Slope Gros	ss Area	ROOF	SKY	LIGHT]				
Exp	(deg)	(sqft)	Type	Type	Qty					4
			-75-		~~~~~					
S	5	412.0	4	1	0					
=====				 =====:	======	=====	=====			
PARTI	TION LOADS	T	pe 1			ጥ	ype 2			
Type	• • • • • • • • • • • • •	: Part:	ition			Part	ition			
Area	• • • • • • • • • • • • •		L48.0	saft				sqft		
U-valu	ıe	: (.212	BTII/bi	c/sqft/F	•	0.010	BTU/hr/	/caft/F	
Maximu	ım Space Temp.	:	85.0	F	, - 1 - / -		75.0	F	odre/r	
Outsid	le Air Temp @	max:	97.0	F			55.0			
Minimu	m Space Temp.	:	45.0				74.0	_		
Outsid	le Air Temp 🤄	Min:	7.0				54.0	_		
	========							<u>-</u>		

DIACH DEDCRIFTION	
Prepared by: Keller & Gannon	12-20-94
HAP v3.06	Page 1
***************	*****
GENERAL SCHEDULES	
Name: 117-3: 13. Corridor&Jan Lighting: 117-3 Schedul	
Floor Area: 139.0 sqft Task Lights.: 117-3 Schedul	е
Building Weight: 70.0 lb/sqft People: 117-3 Schedul	е
Windows Shaded? N Equipment: Continuous	
Partitions Used.? N Misc. Sens.: Lights	
LIGHTING Misc. Latent: Lights	
Overhead Fixture: Recessed INFILTRATION	
Lamp Wattage: 440.0 W Cooling: 0.00 CFM	
Ballast Mult: 1.00 Heating: 0.00 CFM	
Task Lighting: 0.00 W/sqft Typical: 0.00 CFM	/sqft
PEOPLE When Fan On.? N	
Occupancy: 0 People FLOOR	
Activity Level: Heavy Work Type:Slab On Grade	
Sensible: 525.0 BTU/hr Perimeter:	0.0 ft
Latent 925.0 BTU/hr Slab Floor Area:	139.0 sqft
OTHER LOADS Floor R-Value:	0.50
Equipment: 0.00 W/sqft Insulation R-value:	7.00
Misc. Sensible: 0.0 BTU/hr	
Misc. Latent: 0.0 BTU/hr	
No external wall or window data for this space.	
ROOF Slope Gross Area ROOF SKYLIGHT	
Exp (deg) (sqft) Type Type Qty	
Tub (mod) (pdro) (rlbo rlbo %ol	
S 5 139.0 4 1 0	
No partition data for this space.	
-	

Prepared by: Kel	ler & Ganno	on						12-20	-94
HAP v3.06								Page	1
GENERAL	*****		*****		*****	*****	****	****	***
Name: 117	-3: 14. Mer	va mosi	_	CHEDULE	_	445 0	a -1 1-		•
Floor Area			ec	Lightin	ıg	117-3	Schedi	nīe	
Building Weight		0 sqft	.e.	Task Li					
Windows Shaded.	•• /0•	0 lb/sq	IL	People.		117-3	Schedu	nīe	
Partitions Used		N N		Equipme	nt:	Conti	nuous		
LIGHTING	• •	14		Misc. S	ens:	right	s		
Overhead Fixture	o. Dogoggod	1		Misc. L		ridut	s		
Lamp Wattage				NFILTRA					
Ballast Mult	.: 340. .: 1.0			Cooling	• • • • • •			FM/sqft	
Task Lighting		-		Heating				M/sqft	
PEOPLE	• • • • • • • • • • • • • • • • • • • •	0 W/sqf		Typical		1		M/sqft	
	•	0 0 1		When Fa	n on.?		N		
Occupancy	· ·	2 People		LOOR	_				
Activity Level.				Type	• • • • • • • •	Slab O	n Grade		
Sensible		0 BTU/h:		Perimet				10.5 ft	
LatentOTHER LOADS	.: 120.	0 BTU/h		Slab Fl	oor Are	ea	:	200.0 sq	1ft
		0 77 / 64	_	Floor R	-Value.	• • • • •	:	0.50	
Equipment		0 W/sqf		Insulat	ion R-v	ralue.	:	7.00	
Misc. Sensible		0 BTU/h							
Misc. Latent	·: 0.	0 BTU/h	r						
WALL Gross Area	WALL	======= t.7:			======	=====		========	
Exp (sqft)			INDOW			INDOW	<i>-</i>	Any	
Typ (Sdir)	Type	Type	Qty	Shade	Type	Qty	Shade	Doors?	
W 84.0	4	1	0		1 1	0		N	
	:======= -	<u>-</u>	====:		<u>-</u>			_=========	==
	oss Area	ROOF		LIGHT					
Exp (deg)	(sqft)	Type	Type	Qty					
S 5	200.0	4	1	0	į.				(
No partition data	for this	======= =nace				=====			==
No partition data for this space.									

			SCKILLION				
Prepared by: Kell	er & Gannoı	ו					12-20-94
HAP v3.06							Page 1
*********	*****	****	*****	*****	****	*****	*******
GENERAL			SCHEDULE	S			
Name: 117-	3: 15 Womer	's Toilet	Lightin	a:	117-3	Schedu	le
Floor Area) sqft	Task Li				
Building Weight.		lb/sqft	People.				
Windows Shaded			Equipme				
Partitions Used.			Misc. S				
LIGHTING	•	•	Misc. L				
Overhead Fixture	Recessed		INFILTRA				
Lamp Wattage		W	Cooling			0.00 CF	M/saft
Ballast Mult		* '	Heating			0.00 CF	
Task Lighting		W/sqft	Typical			0.00 CF	
PEOPLE		11,0410	When Fa		,	N N	ii, bar c
Occupancy	. 3	People	FLOOR	0		••	
Activity Level			Type	• 5	lah O	n Grade	
Sensible	230.0	BTU/hr	Perimet				16.0 ft
Latent		BTU/hr	Slab Fl				250.0 sqft
OTHER LOADS	120.0	DIO, III	Floor R				0.50
Equipment	1 00	W/sqft	Insulat				7.00
Misc. Sensible		BTU/hr		IOII K-V	alue.	• • • •	7.00
Misc. Latent		BTU/hr					
MISC. Datellt							
WALL Gross Area	WALL	WINDO			INDOW		Any
Exp (sqft)	Type		• •			Shade	Doors?
Exp (Sqlt)	l TAbe l	Type Qty	Silaue	Туре	Qty	Silaue	DOOLS:
W 128.0	4	1 0	· –	1	0	_	l N
				! =======	=====		
ROOF Slope Gro	ss Area	ROOF SK	YLIGHT	1			
Exp (deg)	(sqft)	Type Typ	e Qty				
S 5	250.0	4	1 0				
						======	
No partition data	for this s	pace.					

HAP	ared by: Kelle v3.06 ******			*****					Pac	20-94 ge 1
GENER			****				****	*****	*****	****
		. 1 1/1	l- D- D'		CHEDULE		- 2			
	⊇: 117-5): 1. WOT.	K KM B.		Lightin					
FIOC	or Area	3679.			Task Li				_	
Dull Wind	lding Weight.: lows Shaded?	/0.	0 lb/s	dir				Schedu		
		-	N					Schedu		
	citions Used.?	,	¥					Schedu		
LIGHT		D **					117-5	Schedu	le	
	head Fixture:				NFILTRA					
	Wattage:				Cooling	••••		0.00 CF	M/sqft	
Ball	ast Mult:	1.00			Heating	• • • • • •		0.00 CF 00.0 CF	M/sqft	
	Lighting:	0.00) W/sqi	ft	Typical	• • • • • • •	22		M	
PEOPL					When Fa	n On.?		Y		
	pancy:		Peop		LOOR					
	vity Level:	Heavy Wor	:k					n Grade		
	ible:		BTU/I	ır	Perimet				183.1	ft
	nt:	925.0) BTU/l	ır	Slab Fl	oor Are	a	:	3679.0	sqft
	LOADS				Floor R	-Value.		:	0.50	
Equi	pment:	10.00) W/sqf	:t	Insulat	ion R-v	alue.	:	7.00	
Misc	. Sensible:	5000.0	BTU/h	ır						
Misc	. Latent:	67940.0	BTU/h	ır						
WATT				 	======	=======================================	=====			====
WALL		WALL		INDOW	G1 3 -		INDOW		Any	
Exp	(sqft)	Туре	Type	Qty	Shade	Type	Qty	Shade	Doors?	
N	2776.1	i 7	1	0		 1				
E	2869.1	7	i	0	_	1	0	-	N	
w	2869.1	7	1	0	_	1	0	-	N	
=====	2009.1 =========	!		U		1	0		N	
ROOF	Slope Gro	ss Area	ROOF	CKAI	LIGHT		:			====
Exp	(deg)	(sqft)								
		(SQIC)		Туре	Qty					
HOR	-	3679.0	6	1	0					
=====		=======	=====	<u></u>	 	=====	=====			
PARTIT	TION LOADS	T	ype 1			T	ype 2			
Tuno			 :+:							
TAbe.	• • • • • • • • • • • •			C-L			ition	٠.		
			928.3				B47.7			
	le		U.541	p.r.n\ur	:/sqft/F	,	U.541	BTU/hr/	sqft/F	
Maximu	m Space Temp.	i	85.0				80.0			
Vuts10	de Air Temp @	max:	97.0				97.0			
Minimu	m Space Temp.	:	55.0	-			55.0	_		
	le Air Temp @		7.0	f' 			7.0	F		

_			SPAC	'E DES	CKIPIIO	N				
Prep	ared by: Kell	ler & Ganno	n						12-	20-94
	v3.06								Pa	
	*****	******	*****	****	*****	*****	****	*****		****
GENE		_			SCHEDULI					
	e <u>.</u> : 117-		k Rm F		Lightir	ıg:	Light	s		
	or Area		0 sqft		Task Li	ights.:	Light	:s		
Bul.	lding Weight.	70.	0 lb/s	qft	People.		117-5	Schedu	ile	
	lows Shaded		N		Equipme	ent:	117-5	Schedu	ile	
	citions Used.	?	Y		Misc. S	ens:	117-5	Schedu	ile	
LIGHT					Misc. I	atent:	117-5	Schedu	פוו	
Over	chead Fixture	: Free-Han	ging		INFILTRA	TION		Domean		
Lamp	Wattage	: 14430.	ŌW		Cooling			0.00 CF	M/enft	
Ball	last Mult	: 1.0	0		Heating			0.00 CF	M/saft	
Task	Lighting	: 0.0	0 W/sq	ft	Typical	:	5	00.0 CF	M, Pdrc	
PEOPI	Æ		, -		When Fa	n On.?		Y	11	
0ccu	pancy	: 1	0 Peop	le 1	LOOR			•		
Acti	vity Level	: Heavy Wo	rk		Type	• 6	:lah O	n Grado		
Sens	ible	. 525.		hr	Perimet	or	Tab O	. Grade		£±
Late	nt		O BTU/	hr	Slab Fl	OOR Arc	••••	• • • •	183.1	
OTHER	LOADS		,	•••	Floor R	-Majno	a	••••	3679.0	sqit
	pment	: 10.0	0 W/sq:	f+	Insulat	-varue.		• • • •	0.50	
Misc	. Sensible		D BTU/		Insulat	TOIL K-V	arue.	• • • •	7.00	
Misc	. Latent	67940.								
=====	=========	========								
WALL	Gross Area	WALL	1 1	WINDOW	: '	 	TNDOW	=====:		====
Exp	(sqft)	Type	Туре			1	INDOW	6 1 3	Any	
				QCY	Snade	Туре	Qty	Shade	Doors?	
N	2776.1	7	1	0		1 7				
E	2869.1	7	ī	ő		1	0	_	N	
W	2869.1	1	ī	ő	_	1 1	0	-	N	
=====	===========		=====				0		N	
ROOF	Slope Gro	ss Area	ROOF	l sky	LIGHT				======	====
Exp	(deg)	(sqft)	Type	Type						4
			-720							•
HOR	-	3679.0	6	1 1	o					
=====		=======	=====	:=====:	 =======					_
PARTI	TION LOADS	T	ype 1			dr.	ype 2			
						·	7 PC 2			
Type	• • • • • • • • • • •	···: Part	ition			Part	ition			
Area	• • • • • • • • • • •	: 1	928.3	saft.			347.7	saft		
U-valu	ıe		0.541	BTU/h	r/sqft/F	,	5/1	Butt /p~ \	aaft /P	
Maximu	ım Space Temp	:	85.0	F ,	-, , -	•	80.0	BTU/hr/	adrc\t	
Outsid	le Air Temp َ 🏻	Max:	97.0				97.0	_		
Minimu	ım Space Temp	:	55.0							
Outsid	le Air Temp 0	Min:	7.0				55.0 7.0			
	========		=====	- ======			, . U	F		

Prepa HAP v	ared by: Kelle	er & Ganno		.E DES	CRIPTION				Pac	20-94 ge 1
	*******	*****	****	****	*****	*****	****	*****	*****	****
GENER	RAL				SCHEDULE	S				
Name	2: 117-5	5: 3. Mech	nanica	l Rm	Lightin	g:	Light	s		
Floc	or Area				Task Li	ghts.:	Light	s		
Buil	ding Weight.:	70.0	lb/s	qft	People.	:	117-5	Schedu	le	
Wind	lows Shaded?	?	1		Equipme	nt:	117-5	Schedu	le	
Part	itions Used.?	, ,	Z		Misc. S					
LIGHT	ING				Misc. L	atent:	Light	s		
Over	head Fixture:	Free-Hand	ging		INFILTRA		_			
	Wattage:		-		Cooling	:		0.00 CF	M/saft	
Ball	ast Mult:	1.00)		Heating			0.00 CF	M/saft	
Task	Lighting:	0.00) W/sq	ft	Typicaĺ			50.0 CF		
PEOPL	E		, - 1		When Fa			Y		
	pancy:	2	Peop	le 1	FLOOR			-		
	vity Level:				Type		Slab O	n Grade		
	ible:		BTU/	hr	Perimet	er		:	161.7	ft
	nt				Slab Fl				2049.0	
	LOADS	155.0	, D10,		Floor R				0.50	0410
	pment:	7.00	W/sq	ft.	Insulat				7.00	
	. Sensible:		BTU/			1011 10	'uruc'		,,,,	
	. Latent:		BTU/							
=====		=======	=====			======				====
WALL	Gross Area	WALL	1	WINDOW	7.	V	WODNI		Any	
Exp	(sqft)	Type	Type	Qty	Shade	Type	Qty	Shade	Doors?	•
									<u>-</u>	
S	592.1	7	1	0	_	1	0	_	N	
E	852.0	7	1	0	-	1	0	_	N	
W	852.0	7	1	0	_	1	0	_	N	
			=====	=====	=======		=====			====
ROOF	Slope Gro	ss Area	ROOF	SKY	LIGHT	İ				
Exp	(deg)	(sqft)	Type	Type	Qty					
HOR	-	2368.0	6	1	. 0					
							=====			====
PARTI	TION LOADS	T	ype 1			I	ype 2			
Type		· Dart	ition			Ceil	ina			
			847.7	caft			238.8	aaft		
					~/~~f+/1				lawfh /E	
					r/sqft/I	?		BTU/hr/	sdrc\t	
	m Space Temp		80.0				85.0	_		
	de Air Temp @		97.0				97.0			
	m Space Temp		58.0				55.0	_		
	de Air Temp 0 		7.0 =====	r 			7.0	r		

HAP v3									Dag	0-94 e 1
*****	******	*****	****	****	*****	*****	****	*****	******	
GENERA					SCHEDULE	S				
	: 117-5				Lightin	g:	Light	s		
Floor	Area:		o sqft		Task Li	ghts.:	Light	s		
Build	ling Weight.:	70.0	lb/s	qft	People.				ule	
Windo	ws Shaded?	1			Equipme	nt:	117-5	Sched	ule	
	tions Used.?	,	Z		Misc. S	ens:	Light	s		
LIGHTI					Misc. L	atent:	Light	s		
Overh	ead Fixture:	Recessed			INFILTRA	TION	J	-		
Lamp	Wattage:	90.0) W		Cooling			0.00 C	FM/sqft	
	st Mult:				Heating	:		0.00 C	FM/sqft	
Task	Lighting:	0.00) W/sq	ft	Typicaĺ	:		0.00 C	FM/sqft	
PEOPLE					When Far	n On.?		N .	,	
	ancy:		Peop	le E	LOOR			-		
Activ	ity Level:	Office Wo	rk		Type	: 5	lab O	n Grade	a	
Sensi	ble:	245.0	BTU/	hr	Perimete	er		:	4.3 1	F+-
Laten	t	205.0	BTU/	hr	Slab Flo	or Are	a	•	92.0	
OTHER :	LOADS		•		Floor R-	-Value.		••••	0.50	odic
Equip	ment:	0.00	W/sa:	ft	Insulati	ion R-v	מוו בי	• • • •	7.00	
Misc.	Sensible:		BTU/I	ar			uruc.	• • • •	7.00	
Misc.	Latent:		BTU/I							
=====			====:	=====				======		
	Gross Area	WALL	7	VINDOW	' i	W	INDOW		Any	
Exp	(sqft)	Туре	Type	Qty	Shade			Shade		
***						-77			7 20013.	
W ======	34.0 ========	7 =======	1 =====	0	 	1	0	-	N	
No roof	or door dat	a for thi	s spac	e.						
PARTITI	ON LOADS	T	ype 1			 T	-==== уре 2			===
Type	• • • • • • • • • • • • • • • • • • • •	• Dart	ition							
Area	•••••	· · · · ·	172 g	eaft		Ceil				
U-value	Space Town	:	1 212	BUIL / P	r/caft/P		92.0	SQIT		
Maximum	Space Temp.	:	85.0	F	r/adrr/t	,	0.0/5	PIO/UL	/sqit/f	
Outside	Air Temp @	Max:	97 0	<u>-</u> ਜ			85.0			
Minimum	Space Temp	!	55 0	r r			97.0	_		
Outside	Space Temp. Air Temp 0	Min:	7 0	ਜ਼ ਸ			55.0	_		
	===============		,	<u>. </u>			7.0	r ·		

Prepared by: Keller & Gannon HAP v3.06	12-20-94 Page 1
**************************************	********************************** SCHEDULES Lighting: Lights Task Lights.: Lights People: 117-5 Schedule Equipment: 117-5 Schedule Misc. Sens: Lights Misc. Latent: Lights INFILTRATION Cooling: 0.00 CFM/sqft Heating: 0.00 CFM/sqft Typical: 0.00 CFM/sqft When Fan On.? N FLOOR Type:Slab On Grade Perimeter: 0.00 ft
Latent: 205.0 BTU/hr OTHER LOADS Equipment: 0.00 W/sqft Misc. Sensible: 0.0 BTU/hr Misc. Latent: 0.0 BTU/hr	Slab Floor Area: 34.0 sqft Floor R-Value: 0.50 Insulation R-value: 7.00
No roof or door data for this space.	nis space.
PARTITION LOADS Type 1	
Type	Coiling

Prepared by: Kelle HAP v3.06				·	•				20-94
**********	******	*****	****	******	****	****		Pac ******	·
GENERAL				SCHEDULE					****
Name: 117-5	: 6. Men'	s Toil		Lightin		Liaht	- 6		•
Floor Area:		sqft		Task Li	ghte .	Light	-5		
Building Weight.:		lb/sq	rf+					. 1 .	
Windows Shaded?			Į L C	People.		117 5	Schedu	116	
Partitions Used.?				Equipme	116:	11/-5	Scheau	те	
LIGHTING	-	•		Misc. S	ens:	Light	S		
Overhead Fixture:	Free-Pane	·1 ~~	-	Misc. L	atent:	глдил	S		
Lamp Wattage:	rree-nang		4	INFILTRA					
Ballast Mult:	260.0			Cooling	• • • • • •		0.00 CF	M/sqft	
Tack Lighting			·	Heating	• • • • • •		0.00 CF	M/sqft	
Task Lighting: PEOPLE	0.00	w/sqr	τ	Typical	•••••		0.00 CF	M/sqft	
	_			When Fa	n On.?		N		
Occupancy:	2	Peopl	e F	LOOR					
Activity Level:	Seated at	Rest		Type	: 5	lab 0	n Grade	:	
Sensible:	230.0	BTU/h	r	Perimet	er		:	12.0	ft.
Latent:	120.0	BTU/h	r	Slab Flo	oor Are	a	:	154.0	
OTHER LOADS				Floor R	-Value.			0.50	-41
Equipment:	0.00	W/saf	t	Insulat	ion R-v	alue	• • • •	7.00	
Misc. Sensible:		BTU/h			,	arac.	• • • •	7.00	
Misc. Latent:		BTU/h	r						
	=======	=====	- =====						
WALL Gross Area	WALL	W:	INDOW		w	INDOW			====
Exp (sqft)	Type	Type			Туре			Any	
								Doors?	
S 96.0	4	1	0	-	1	0	-	l N	
No roof or door dat	a for this	s space	≥.				=====	======	====
PARTITION LOADS		/pe 1				===== ype 2	=====:		====
									{
Type	: Parti	ition			Ceil.	ina			
Area	: 1	L84.0 s	saft	•	•	15 <i>1</i> 0	saft		
U-value	:).212 E	SŤU/h	r/saft/F	,	0.075	BTII/hr	/caf+/F	
				-,,-	,	85.0	E C/III/	adrc/ L	
Outside Air Temp @	Max:	97.0 F	7			97.0			
Minimum Space Temp.	:	55.0 F				55.0	_		
Outside Air Temp @	Min:	7.0 F							
		,				7.0	F		

Prepared by: Keller & Gannon HAP v3.06	12-20-94 Page 1
**************************************	sqft
Misc. Latent: 0.0 BTU/hr WALL Gross Area WALL WINDOW WINDOW Exp (sqft) Type Type Qty Shade Type Qty Shade I	Any Doors?
S 108.8 4 1 0 - 1 0 - E 112.8 4 1 0 - 1 0 -	N N
No roof or door data for this space.	
PARTITION LOADS Type 1 Type 2	
Type	ift/F

HAP v				L DEB	SKIPTION	•			12-20 Page	
	************	*****	*****				****	*****		****
GENER	кац 2: 117-5	5 • Wk/Mah	Dm Dl		CHEDULE		T 3	_		
	or Area		8 sqft	enum	Lightin	g	Light	S		
	ding Weight.		0 lb/s		Task Li People.	gnus.:	117-5	Sahadı Sahadı	130	
	lows Shaded ?		N II, D	4-0	Equipme	nt:	117-5	Schedu	176	
	itions Used.?		Y		Misc. S					
LIGHT					Misc. L	atent:	Light	s		
Over	head Fixture:	Free-Han	ging	1	NFILTRA	TION	_			
Lamp	Wattage:	400.			Cooling	••••		0.00 CF	M/sqft	
	ast Mult: Lighting:				Heating		:	0.00 CF	M/sqft	
PEOPL	E	0.0	o w/sq:		Typical When Fa		•	0.00 CF	M/sqft	
	pancy:		0 Peop		LOOR	ii Oii.:		N		
Acti	vity Level:	Seated a	t Rest			:A	bove (Conditi	oned Space	:e
Sens	ible:	230.	O BTU/l	ır					onea bpac	
	nt:	120.	O BTU/l	ır ·						
	LOADS	0.00	0 57 / 4	•1						
Misc	pment: . Sensible:		W/sqf							
Misc	Latent:		D BTU/h D BTU/h							•
	=========	========	======	:===== :-	======	======				
WALL		WALL	W	INDOW		l w	INDOW		Any	
Exp	(sqft)	Type	Type	Qty	Shade	Type	Qty	Shade	Doors?	
S	1928.3	10	1	0		1	0		 N	
E	129.2	7	1	ŏ	-	ī	ŏ	_	N	
W	129.2	7	1	0	-	1	ŏ	-	n	
ROOF	Slope Gro	ss Area	ROOF	CVV	TOUR		=====			===
Exp	(deg)	(sqft)	Type	Type	LIGHT Qty					4
								•		•
HOR	· -	238.8	· 6	1	0					
דייים עם	ION LOADS			=====	======	=====:		======		===
LUVITI	TON LOADS	T 	ype 1			T	/pe 2			
Type	• • • • • • • • • • • •	: Part	ition			Ceili	nα			
Area	• • • • • • • • • • • •	: 3	122.3	sqft			-	sqft		
U-valu	le. <u>.</u> <u>.</u>	:	0.541	BŤU/hr	/sqft/F	' (BTU/hr/	'saft/F	
Maximu	m Space Temp.	:	80.0	F	-		85.0		- ,-	
Minimu	le Air Temp @	max:	97.0	F			97.0	F		
**************************************	m Cnace Me		E0 0 '							
Outsid	m Space Temp. e Air Temp @	: Min:	58.0 1 7.0 1	_			55.0 7.0			

	TEM INPUT DATA
Name: UH-701. 2 Htrs, 117-1 Mech R	m BL 11-03-94
Type: TERMINAL UNITS - 2-Pipe Fa	n Coils HAP V3.00
Despend by Vollor & Cannon	Page 1
*********	***********
1. SYSTEM NAME AND TYPE	
Name: UH-701. 2 Htr Type: TERMINAL UNIT Number of Zones.: 1	s,117-1 Mech Rm BL S - 2-Pipe Fan Coils
2. SYSTEM DESCRIPTION	
COOLING SYSTEM DATA	
Supply Air	315.0 CFM
Fan Cycled for Cooling?	N 0. 100
Coil Bypass Factor	0.100
HEATING SYSTEM DATA	Y
Fan Cycled for Heating?	110.0 F
Supply Air Temperature? OUTDOOR VENTILATION DATA	110.0 1
Common Ventilation System Used?	N
SAFETY FACTORS	
Sensible Cooling Factor:	0 %
Latent Cooling Factor	0 %
Heating Factor	0 %
OUTDOOR VENTILATION DATA	
Type of completeless	Constant Airflow Rate
Design Ventilation Airflow:	0.0 CFM
3. ZONE DATA	
ZONE	1 (All Zones the Same)
T-Stat Occupied Cooling(F):	90.0
Unoccupied Cooling(F):	120.0
Occupied Heating(F):	55.0
Unoccupied Heating(F):	55.0
Throttling Range(F):	3.0
Zone Terminal Type:	Fan Coil
Fan kw	0.2
Fan Efficiency(%):	
_#=====================================	

Name: UH-701. 2 Htrs,11 Type: TERMINAL UNITS - Prepared by: Keller & Ga ************************************	2-Pipe Fan Coils	11-03-94 HAP v3.06 Page 2
4. SCHEDULE DATA		
HOURLY TSTAT SCHEDULES	0 0 0 0 0 0 0 0 0 1 1	1 1 1 1 2 2 2 2
Design Day	X	X X X X X X X X X X
Cooling Available During	J Unoccupied Period ? N	
MONTHLY SCHEDULES	JAN FEB MAR APR MAY JUN JUL A	UG SEP OCT NOV DEC
Terminal Heating Terminal Cooling	xxx xxx xxx xxx xxx xxx xxx x	xx xx xxx xxx xxx

AIR SYS	STEM INPUT DATA
Name: UH-701. 2 Htrs,117-1 Mech R Type: TERMINAL UNITS - 2-Pipe Fa Prepared by: Keller & Gannon	Rm R1 11-03-9 An Coils HAP v3.0 Page
******************************	**************
1. SYSTEM NAME AND TYPE	
Name	s,117-1 Mech Rm R1 S - 2-Pipe Fan Coils
2. SYSTEM DESCRIPTION	
COOLING SYSTEM DATA	
Supply Air	315.0 CFM
Fan Cycled for Cooling? Coil Bypass Factor:	N 0.100
HEATING SYSTEM DATA	0.100
Fan Cycled for Heating?	Y
Supply Air Temperature?	110.0 F
OUTDOOR VENTILATION DATA Common Ventilation System Used?	N
SAFETY FACTORS	- "
Sensible Cooling Factor:	0 %
Latent Cooling Factor	0 ዩ 0 ዩ
Heating Factor	0 %
Type of Control:	Constant Airflow Rate
Design Ventilation Airflow:	0.0 CFM
3. ZONE DATA	
ZONE	1 (All Zones the Same)
T-Stat Occupied Cooling(F):	90.0
Unoccupied Cooling(F): Occupied Heating(F):	120.0 45.0
Unoccupied Heating(F):	45.0
Throttling Range(F):	3.0
Zone Terminal Type	Fan Coil
Fan kW	0.2 -

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	$ \begin{smallmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0$
Design Day	X X X X X X X X X X
Cooling Available During	Unoccupied Period ? N
MONTHLY SCHEDULES	JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
Terminal Heating Terminal Cooling	XXX XXX

Name: UH-701. 2 Htrs,117-1 M Type: TERMINAL UNITS - 2-Pi Prepared by: Keller & Gannon	pe Fan Co:		11-03-94 HAP v3.06 Page 1
1. SPACE SELECTION			
Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
21. 30. Mechanical Room	1		

AIR SYSTEM INPUT DATA Name: Anex Fan&Elec Htg Coil, 117-1 BL Type: CONSTANT VOLUME - Tempering System Prepared by: Keller & Gannon **********************************	11-03-94 HAP V3.06 Page 1 ******
Name: Anex Fan&Elec Htg Coil, 117-1 BL Type: CONSTANT VOLUME - Tempering System Number of Zones:: 1	
2. SYSTEM DESCRIPTION	
OUTDOOR VENTILATION DATA Design Ventilation Airflow: 600.0 CFM SUPPLY FAN DATA Fan Type	
4. SCHEDULE DATA	
HOURLY TSTAT SCHEDULES 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1	2 2 2 2 2 2 0 1 2 3
Design Day	X X X X X X X X X X

Central Heating...... | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX | XXX |

MONTHLY SCHEDULES

| JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |

Name: Annex Fan and Electric Type: CONSTANT VOLUME - Simple Prepared by: Keller & Gannon **********************************	ole CAV n	******	10-31-94 HAP v3.06 Page 1
1. SPACE SELECTION Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)	=========		
22. 33,34,35&36. Annex	1		

AIR SYS	TEM INPUT DATA	
Name: AC-701 ACTUAL Conditions, 117	-1 BL	11-03-9
Type: CONSTANT VOLUME - Dual Duct	CAV	HAP v3.0
Prepared by: Keller & Gannon **********************************		Page :
	******	*****
1. SYSTEM NAME AND TYPE		
Name AC-701 ACTUA		
Type CONSTANT VOLU	ME - Dual Duct CAV	
Number of Zones.: 6		
2. SYSTEM DESCRIPTION		
COOLING SYSTEM DATA		
Cold Deck Temperature:	55.0 F	
Coil Bypass Factor:	0.100	
Cold Deck Reset:	Not Used	
HEATING SYSTEM DATA		
Hot Deck Temperature:	105.0 F	
Hot Deck Reset	Not Used	
OUTDOOR VENTILATION DATA		
Type of Control	Constant Airflow Rate	
Design Ventilation Airflow:	0.0 CFM	
Dampers Open During Unocc Per.:	N	
Damper Leak Rate	0 %	
Duct Heat Gain:	2 %	
Duct Leakage Rate	2 % 2 %	
RETURN PLENUM DATA	2 7 ,	
Is a Return Plenum Used?	N	
SUPPLY FAN DATA	24	
Fan Type:	Forward Curved	
Fan kw:	7.5 kW	
RETURN FAN DATA		
Fan Type:	Forward Curved	
Fan kw:	0.7 kW	
OUTDOOR AIR ECONOMIZER		
Outdoor Economizer Type:	None	
PREHEAT COIL		
Preheat Coil Used?	N	
PRECOOL COIL		
Precool Coil Used?	N	
VENTILATION HEAT RECLAIM	None	
Reclaim Unit Type: SAFETY FACTORS	None	
Sensible Cooling Factor:	= 4	
Latent Cooling Factor	5 % 5 %	
Heating Factor	5 % 5 %	
	5 B	

Name: AC-701 ACTUAL Cor Type: CONSTANT VOLUME - Prepared by: Keller & Ga	diti Dua: nnoi	l Di n	117 uct	-1 : C	BI AV	_				***	**	**	**	t * *	**	**;	HA	P Pa	v3 ge	-94 .06 2 ***
3. ZONE DATA																				
ZONE T-Stat Occupied Cooling. Unoccupied Coolin	((F) :	 :				 1 5.0 5.0				5.0 5.0				75 85					4 5.0 5.0
Occupied Heating. Unoccupied Heatin Throttling Range.	g((F) : (F) :				7 6	0.0 0.0 3.0			7 6	0.0 0.0 3.0	0			70. 60.	. 0			7(6(0.0
Zone Heating Unit Type Trip Temperature Design Supply Temperat Fan Total Static(i	(ure((F):				N	one - -			N	one - -	= - -		,	Noi	ne - -			No	one - -
Fan Efficiency Zone Terminal Type Reheat Coil	• • • •	(ક) : • • • ?		c	:AV		Box	c	AV	' MI	N	1	CA	.V]		N	C	ΑV		- Box N
Diversity Factor Direct Exhaust Airflow Direct Exhaust Fan kW	. (CF	'M):				47	100 0.0 0.3		1	88	100 0.0 1.4)		2	00. 00.			14	450	0.0
T-Stat Occupied Cooling. Unoccupied Cooling. Occupied Heating. Unoccupied Heating. Throttling Range. Zone Heating Unit Type Trip Temperature Design Supply Temperature Fan Total Static(in Fan Efficiency	g(g(g((ure(n.wg	F): F): F): F): F): F): F): F):		c	AV	85 76 60 No	5.0 5.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	C	ΑV	85 70 60 3 No	5.0 5.0 5.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0									
Direct Exhaust Airflow Direct Exhaust Fan kW	(CF	M):	===		14	150	.0	:	-=:	0	.0		==:	===		===	===	===		==
4. SCHEDULE DATA		:																		
HOURLY TSTAT SCHEDULES	0 0 0 1	0 2	0 0	0 5	0 6	0 7	0 0 8 9	0	1	1 2	1 3	1	1 : 5 0	1 1	1 8	1 9	2 0	2	2 2	2 3
Design Day Weekday Saturday Sunday					X X X	X X X	X X X X X X	X X X	X X X	X X X	X X X	X X X	X X X X	X X X X X X	X X X	X X X	X X X	X X X		
Cooling Available During	Uno	ccup	oie	d I	er	io	d ?		/ / ===		==:				==:					==
MONTHLY SCHEDULES	JAN	FE	3 M	AR	AP	R	MAY	JT	JN	JU	L Z	AU(G S	EP	0	CT	NO	<u>v </u>	DE	<u> </u>
Central Heating	XXX	XXX	K X	XX	XX		XXX XXX		κx	XX	x z	XX:	x x	XXX		XX XX	XX	X	XX	x

AIR SYS	TEM INPUT DATA	-
Name: AC-701 ACTUAL Conditns, 117	-1 R1	11-03-94
Type: CONSTANT VOLUME - Dual Duct	CAV	HAP v3.06
Prepared by: Keller & Gannon		Page 1
*********	********	*************
1. SYSTEM NAME AND TYPE		
Name AC-701 ACTUA	L Conditns.117-1 R1	
Type CONSTANT VOLU	ME - Dual Duct CAV	
Number of Zones.: 6		•
2. SYSTEM DESCRIPTION		
COOLING SYSTEM DATA	55.0 7	
Coil Bypass Factor	55.0 F	
Cold Deck Temperature: Coil Bypass Factor: Cold Deck Reset:	0.100	
Wayimum Boget Wammanatura	Greatest Demand	
Maximum Reset Temperature: HEATING SYSTEM DATA	65.0 F	
Hot Deck Temperature	105.0 F	
Minimum Poset Momporature	Greatest Demand	
Minimum Reset Temperature: OUTDOOR VENTILATION DATA	90.0 F	
Type of Control	Constant Airflow Rat	e
Design Ventilation Airflow:	5125.0 CFM	
Dampers Open During Unocc Per.:	N	
Damper Leak Rate	0 %	
SUPPLY DUCT DATA		
Duct Heat Gain	2 %	
Duct Leakage Rate RETURN PLENUM DATA	2 %	
Is a Return Plenum Used?		
SUPPLY FAN DATA	N	
Fan Type:	Former of	
Fan kw		
RETURN FAN DATA	7.5 kW	
Fan Type	Forward Curved	
Fan kw	0.7 kW	
OUTDOOR AIR ECONOMIZER	0.7 KW	
Outdoor Economizer Type:	Integrated Dry-Bulb	
OA Upper Cutoff Temp	150.0 F	
OA Lower Cutoff Temp	-60.0 F	
PREHEAT COIL		
Preheat Coil Used?	N	
PRECOOL COIL		
Precool Coil Used?	N	
VENTILATION HEAT RECLAIM		
Reclaim Unit Type	None	
SAFETY FACTORS		•
Sensible Cooling Factor:	0 %	
Latent Cooling Factor	0 %	
Heating Factor:	0 %	

Name: AC-701 ACTUAL Co Type: CONSTANT VOLUME - Prepared by: Keller & G ***********************************	Du ann	ia] ior	L I	ouc	ct	CI	V		**	**	**	**	**	**	**	**:	**	**	***		HA	P Pa	v3 ge	
3. ZONE DATA																								
ZONE T-Stat Occupied Cooling Unoccupied Cooli Occupied Heating Unoccupied Heati	ng. ng.	• (F) F)	:				8 6 5	8. 5. 8.	0 0 0			8 6 5	8. 5. 8. 5.	0 0 0			8 6 5	8.5.	0 0 0			8 6 5	4 8.0 5.0 8.0
Throttling Range Zone Heating Unit Type. Trip Temperature Design Supply Temperature Fan Total Static(Fan Efficiency	tur	• (e (wg	F) F)	:			1 3 T T	N	3. on	e - - -	0	3 17	N	3. on	e - - -	•	3 77	N	3. on	e - -	•	3.77	N	3.0 one - -
Zone Terminal Type Reheat Coil Diversity Factor Direct Exhaust Airflow Direct Exhaust Fan kW	(. (CF	ዩ) M)	?::				47	Bo 10 0.	N O O	<u>.</u>		88	10	N O O			20	Bo 10 0. 0.	N O O	C.		45	Box N 100 0.0 0.2
ZONE T-Stat Occupied Cooling	ng.	· (((((((((((((((((((F)))),)),))			C		8 6 5 N	8.65.65.65.65.65.65.65.65.65.65.65.65.65.	00000000000000000000000000000000000000	C2	AV	8! 6! 5! No	3.0 3.0 5.0 5.0	000000000000000000000000000000000000000		====		===					
HOURLY TSTAT SCHEDULES	0	0	0 2	0	0 4	0 5	0	0	0 8	0 9	1	1	1 2	1	1 4	1 5	1 6	1	1	1	2 0	2 1	2 2	2 3
Design Day Weekday Saturday Sunday							X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X		
Cooling Available During	Un	100	CCI	ıp:	ie	1 1	er	cio	od	?	Y													
MONTHLY SCHEDULES	JA	N	F	ЕВ	M/	\R	AF	R	MA	Υ	JU	N	JU	r	ΑŪ	JG	SI	P	00	T	NO	V	DE	c
Central Heating Central Cooling	XX	X	ΧΣ	ΚX	XΣ	XX	XX	X	XX XX		XX	x	ХX	x	XX	xx	XX	x		XX XX	XX	X	XX	x j

AIR Name: AC-701 ACTUAL Conditns, Type: CONSTANT VOLUME - Dual E Prepared by: Keller & Gannon **********************************	117-1		11-03-94 AP v3.06 Page 1
1. SPACE SELECTION			
Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
1. 1. Wet Lab Office & Hall 3. 3. Test Cell w/o Hood	1	2. 2. Test Cell & Fume Hood	1 1
SPACES IN ZONE 2 (Zone 2)			
4. 4. Instrument Lab 6. 6. Wet Chemistry Lab	1 1	5. 5. Biochemical Lab 7. 7. Balance & Oven Room	1 1
SPACES IN ZONE 3 (Zone 3)			
8. 8,31,32. Lunch Rm Srvice	1	9. 9,28. Lunch & Coat Rooms	1
SPACES IN ZONE 4 (Zone 4)			
10. 10,11,12,25. Wmn Lockers	1	11. 24,27. Corridor & Janitr	1
SPACES IN ZONE 5 (Zone 5)			
12. 13,14,15,26. Men Lockers	1	13. 23. Corridor	1
SPACES IN ZONE 6 (Zone 6)			
15. 21. Corridor 17. 17. Women's Toilet 19. 19. Office	1 1 1	16. 16. Men's Toilet 18. 18. Office 20. 20. Ordinance Office	1 1 1

	TEM INPUT DATA
Name: AC-601, Control Room, 117-3	
Type: CONSTANT VOLUME - Single Zo	
Prepared by: Keller & Gannon	Page **************
********	*********
1 CUCMEN NAME AND MUDE	
1. SYSTEM NAME AND TYPE	
Namo : AC-601 Contr	n] Poom 117-2 PT
Name	
Number of Zones: 1	ME - Single Zone CAV
2. SYSTEM DESCRIPTION	
COOLING SYSTEM DATA	
Is Central Cooling Used?	Y
Supply Air:	2400.0 CFM
Coil Bypass Factor:	0.100
Fan Cycled for Cooling?	N
Supply Air Reset:	Not Used
HEATING SYSTEM DATA	
Is Central Heating Used?	Y
Fan Cycled for Heating?	N
Supply Air Reset:	Not Used
OUTDOOR VENTILATION DATA	
Type of Control:	Constant Airflow Rate
Design Ventilation Airflow:	900.0 CFM
Dampers Open During Unocc Per.:	Y
SUPPLY DUCT DATA	
Duct Heat Gain:	2 %
Duct Leakage Rate:	2 %
RETURN PLENUM DATA	
Is a Return Plenum Used?	N
SUPPLY FAN DATA	
Fan Type:	Forward Curved
Configuration:	Draw-Thru
Fan kw:	1.5 kW
RETURN FAN DATA	
Fan Type:	None
OUTDOOR AIR ECONOMIZER	
Outdoor Economizer Type:	Integrated Dry-Bulb
OA Upper Cutoff Temp:	150.0 F
OA Lower Cutoff Temp:	-60.0 F
PREHEAT COIL	
Preheat Coil Used?	N
PRECOOL COIL	
Precool Coil Used?	N
HUMIDIFICATION	
Humidification System Used?	N
DEHUMIDIFICATION	•
Dehumidification System Used?	N
VENTILATION HEAT RECLAIM	
Reclaim Unit Type:	None
SAFETY FACTORS	
Sensible Cooling Factor:	0 %
Latent Cooling Factor:	0 %
Heating Factor:	0 %

Name: AC-601, Control Ro Type: CONSTANT VOLUME - Prepared by: Keller & Ga ************************************	Sino	gle n	Zone	CAV		***	***	***	**;	** *:	***	**	HA	Pa	08- v3. ge	06
3. ZONE DATA																
ZONE T-Stat Occupied Cooling.	(g((((ure(n.wg	(F): (F): (F): (F): (F): (*): (*): (M):		Space	-	(A	11	Zon	es	the	• S	ame	===			==
4. SCHEDULE DATA																
HOURLY TSTAT SCHEDULES	0 0 0 1	0 0	0 0	0 0	0 0 8 9	1 0	1 1 1 2	1 1 3 4	1 5	1 6	=== 1 1 7 8	19	2	2 1	2 2	2
Design Day				X X X X	X X X X	XXX	X X X X X X	X X X X	X X X	X X X	X X X X X X	X X X	X X X	X X X		
Cooling Available During	Uno	ccup	ied	==== Peri	od ?	N			===	===:		==:	===	==	===	=
MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	אטד	1 JC	TL A	UG	SE	P O	CT	NC	v	=== DEC	:
				XXX		1	xx x	xx	xx	XXX	$ \mathbf{x} $	XX			XXX XXX	

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
24. 117-3: 2. Control Room 35. 117-3: 13. Corridor&Jan 37. 117-3: 15 Women's Toilet	1 1 1	34. 117-3: 12. Supervsr Offc 36. 117-3: 14. Men's Toilet	1

Name: AC-601, Control Room, 117-3 Type: CONSTANT VOLUME - Single Zo		11-08-94 HAP v3.06
Prepared by: Keller & Gannon	*******	Page 1
1. SYSTEM NAME AND TYPE		
Name	ol Room, 117-3 R1 ME - Single Zone CAV	

2. SYSTEM DESCRIPTION		
COOLING SYSTEM DATA	W	
Is Central Cooling Used?	Y	
Supply Air	2400.0 CFM	
Coil Bypass Factor	0.100 N	
Fan Cycled for Cooling?		
Supply Air Reset	Greatest Demand 65.0 F	
Maximum Reset Temperature: HEATING SYSTEM DATA	05.0 r	
Is Central Heating Used?	Y .	
Fan Cycled for Heating?	N .	
Supply Air Reset	Greatest Demand	
Minimum Reset Temperature:	80.0 F	
OUTDOOR VENTILATION DATA	80.0 r	
Type of Control:	Constant Airflow Rate	
Design Ventilation Airflow:	900.0 CFM	
Dampers Open During Unocc Per.:	Y	
SUPPLY DUCT DATA	•	
Duct Heat Gain:	2 %	
Duct Leakage Rate:	2 %	
RETURN PLENUM DATA		
Is a Return Plenum Used?	N	
SUPPLY FAN DATA		
Fan Type:	Forward Curved	
Configuration:	Draw-Thru	
Fan kw:	1.5 kW	
RETURN FAN DATA		
Fan Type:	None	
OUTDOOR AIR ECONOMIZER		
Outdoor Economizer Type:	Integrated Dry-Bulb	
OA Upper Cutoff Temp:	150.0 F	
OA Lower Cutoff Temp:	-60.0 F	
PREHEAT COIL		
Preheat Coil Used?	N	
PRECOOL COIL		
Precool Coil Used?	N	
HUMIDIFICATION		•
Humidification System Used?	N	
DEHUMIDIFICATION CONTROL OF THE PROPERTY OF TH		
Dehumidification System Used?	N	
VENTILATION HEAT RECLAIM	17 a.u. a	
Reclaim Unit Type:	None	
SAFETY FACTORS		
Sensible Cooling Factor:	0 %	
Latent Cooling Factor:	0 %	
Heating Factor:	0 %	

Type: CONSTANT VOLUME - Single Zone CAV									HAP Pa	08-94 v3.06 ige 2		
3. ZONE DATA	****	***	***	***		****	~ ~ ~ ~					
ZONE T-Stat Occupied Cooling.	g()()()()()() n.wg()	F): F): F): F): F): F): F): M):		9 6 5 pace iffu 160	- - - ser N	(A1	1 Zo	nes	the	Same	•)	
4. SCHEDULE DATA										====		
HOURLY TSTAT SCHEDULES	00	0 0 2 3	0 0 4 5	0 0 6 7	0 0 8 9	1 1 0 1	1 1 2 3	1 1 4 5	1 1 7	1 1 8 9	2 2 0 1	2 2 2 2 3
Design Day Weekday Saturday Sunday				X X X X	X X X X	X X X X X X	X X X X	X X X X	X X X X	X X X X	X X X X	
Cooling Available During	Uno	cup	ied	Peri	od ?	N						
MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	אטע	JUL	AUG	SEP	OCT	NOV	DEC
Space/Skin Heating Central Heating Central Cooling				XXX	XXX		xxx	xxx	xxx	XXX	XXX	XXX

Name: AC-601, Control Room, 117-3 R1	11-08-94
Type: CONSTANT VOLUME - Single Zone CAV	HAP v3.06
Prepared by: Keller & Gannon	Page 1

1. SPACE SELECTION

Space Name Q	ty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
24. 117-3: 2. Control Room 35. 117-3: 13. Corridor&Jan 37. 117-3: 15 Women's Toilet	1 3 1 3 1	34. 117-3: 12. Supervsr Off 36. 117-3: 14. Men's Toilet	îc 1

Name: AC-602, Work Corridor, 117-3 Type: CONSTANT VOLUME - Single Zone Propaged by: Keller & Gannon	EM INPUT DATA BL 11-23-94 CAV HAP v3.06 Page 1
1. SYSTEM NAME AND TYPE	
Name	orridor, 117-3 BL 2 - Single Zone CAV
2. SYSTEM DESCRIPTION	
COOLING SYSTEM DATA Is Central Cooling Used? Supply Air	Y 5700.0 CFM 0.100 N Not Used Y N Not Used Constant Airflow Rate 100 % Y 0 % 0 % N Forward Curved Draw-Thru 3.7 kW
RETURN FAN DATA Fan Type OUTDOOR AIR ECONOMIZER	None
Outdoor Economizer Type: PREHEAT COIL	None N
Preheat Coil Used? PRECOOL COIL	-
Precool Coil Used? HUMIDIFICATION	N
Humidification System Used? DEHUMIDIFICATION	И
Dehumidification System Used? VENTILATION HEAT RECLAIM Reclaim Unit Type SAFETY FACTORS	N None
Sensible Cooling Factor Latent Cooling Factor Heating Factor	0 % 0 % 0 % ============================

Name: AC-602, Work Corridor, 117-3 Type: CONSTANT VOLUME - Single Zor Prepared by: Keller & Gannon **********************************	BL 11-23-94 e CAV HAP v3.06 Page 2 ************************************					
3. ZONE DATA						
ZONE T-Stat Occupied Cooling(F):	1 (All Zones the Same) 75.0 95.0 70.0 60.0 3.0 Space BB Diffuser N 0.0 0.0					
4. SCHEDULE DATA						
HOURLY TSTAT SCHEDULES 0 0 0 0 0 0 0 0 0 0 0 1 2 3 4	0 0 0 0 0 1 1 1 1 1					
Design Day						
Cooling Available During Unoccupied Period ? N						
MONTHLY SCHEDULES JAN FEB M	AR APR MAY JUN JUL AUG SEP OCT NOV DEC					
	XX XXX XXX XXX XXX XXX XXX XXX XXX XXX					

Name: AC-602, Work Corridor, 117-3 Type: CONSTANT VOLUME - Single Zone Prepared by: Keller & Gannon **********************************	R1 11-23-94 e CAV HAP v3.06 Page 1
1. SYSTEM NAME AND TYPE	
Name: AC-602, Work Control Type: CONSTANT VOLUME Number of Zones.: 1	orridor, 117-3 R1 E - Single Zone CAV
2. SYSTEM DESCRIPTION	
COOLING SYSTEM DATA Is Central Cooling Used? Supply Air	Y 5700.0 CFM 0.100 N Greatest Demand 65.0 F Y N Greatest Demand 80.0 F Constant Airflow Rate 100 % Y N O % O % N Forward Curved Draw-Thru
Fan kW	3.7 kW None
Fan Type OUTDOOR AIR ECONOMIZER Outdoor Economizer Type	None
PREHEAT COIL Preheat Coil Used?	N
PRECOOL COIL Precool Coil Used?	N
HUMIDIFICATION Humidification System Used?	N .
DEHUMIDIFICATION Dehumidification System Used?	N
VENTILATION HEAT RECLAIM Reclaim Unit Type	None
SAFETY FACTORS Sensible Cooling Factor: Latent Cooling Factor: Heating Factor:	0 ዩ 0 ዩ 0 ዩ

Name: AC-602, Work Corridor, 117-3 R1 11-23-9 Type: CONSTANT VOLUME - Single Zone CAV HAP v3.0 Prepared by: Keller & Gannon Page ************************************						
3. ZONE DATA						
ZONE T-Stat Occupied Cooling(F):	1 78.0 95.0 68.0 55.0 3.0 Space BB - - - Diffuser N 0.0 0.0	(All Zones	the Same)			
4. SCHEDULE DATA						
HOURLY TSTAT SCHEDULES 0 0 0 0 0 1 2 3	0 0 0 0 0 0 0 4 5 6 7 8 9	1 1 1 1 1 1 1 0 1 2 3 4 5	1 1 1 1 2 2 2 2 2 6 7 8 9 0 1 2 3			
Design Day		X X X X X	X X X X X X X X X X			
Cooling Available During Unoccup	ied Period ?	N				
MONTHLY SCHEDULES JAN FEB	MAR APR MAY	JUN JUL AUG	SEP OCT NOV DEC			
	XXX XXX XXX					

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
25. 117-3: 3. Wrk Corr BL&R1 27. 117-3: 5. Cell 1 29. 117-3: 7. Cell 3 31. 117-3: 9. Cell 5 33. 117-3: 11. Breakdn Area	1 1 1 1	26. 117-3: 4. Inrt Stg BI 28. 117-3: 6. Cell 2 30. 117-3: 8. Cell 4 32. 117-3: 10. Cell 6	L&R1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

Name: AC-602, Work Corridor, 117-3 Type: CONSTANT VOLUME - Single Zon Prepared by: Keller & Gannon	
1. SYSTEM NAME AND TYPE	
Name	
2. SYSTEM DESCRIPTION	
COOLING SYSTEM DATA Is Central Cooling Used? Supply Air Coil Bypass Factor Fan Cycled for Cooling? Supply Air Reset Maximum Reset Temperature HEATING SYSTEM DATA Is Central Heating Used?	Y 5700.0 CFM 0.100 N Greatest Demand 65.0 F
Fan Cycled for Heating? Supply Air Reset	N Greatest Demand 80.0 F Constant Airflow Rate
Design Ventilation Airflow: Dampers Open During Unocc Per.: SUPPLY DUCT DATA	100 % Y
Duct Heat Gain	0 % 0 % N
SUPPLY FAN DATA Fan Type Configuration Fan kW RETURN FAN DATA	Forward Curved Draw-Thru 5.7 kW
Fan Type	None
Outdoor Economizer Type: PREHEAT COIL	None
Preheat Coil Used? PRECOOL COIL	N
Precool Coil Used? HUMIDIFICATION	N
Humidification System Used? DEHUMIDIFICATION	N .
Dehumidification System Used? VENTILATION HEAT RECLAIM	N
Reclaim Unit Type: SAFETY FACTORS	None
Sensible Cooling Factor: Latent Cooling Factor: Heating Factor:	0 % 0 % 0 %

Name: AC-602, Work Corri Type: CONSTANT VOLUME - Prepared by: Keller & Ga ************************************	dor, Singl nnon	117	-3 R	2 CAV	***		***	***	**	***	***		11- AP Pa ***	v3. ge	
3. ZONE DATA															
ZONE T-Stat Occupied Cooling.	g(F (F g(F (F (F ure(F n.wg. (&			9 6 5 pace	-	(A1	1 Z	ones	tl	ne	Sam	.e)			
4. SCHEDULE DATA									===						==
HOURLY TSTAT SCHEDULES		0 0 2 3	0 0 4 5	0 0 6 7	0 0 8 9	$\begin{vmatrix} 1 & 1 \\ 0 & 1 \end{vmatrix}$	1 1 2 3	1 4	1 1 5 6	1 7	1 8	1 9	2 2 0 1	2 2	2 3
Design Day Weekday Saturday Sunday				X X X X X X	X X X X X X	X X X X	X }		X X		X	X	X X		
Cooling Available During	Unoc	cupi	led I	Peri	od ?	N									
MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	אטע	טע[. AU	G S	EP	OC	T	NOV	DF	c
Space/Skin Heating Central Heating Central Cooling	XXX				XXX		XXX	xx	x x	XXX	XX	X	XXX XXX	1	

	FEM INPUT DATA 3 R2B 11-23-94
Name: AC-602, Work Corridor, 117-1 Type: CONSTANT VOLUME - Single Zon	
Prepared by: Keller & Gannon	Page 1

1. SYSTEM NAME AND TYPE	
170ma	
Name	JOTTIGOT, 11/-3 KZB
Number of Zones: 1	ME - Single Zone CAV
Number of Zones.: I	
2. SYSTEM DESCRIPTION	
COOLING SYSTEM DATA	17
Is Central Cooling Used?	Y
Supply Air	5700.0 CFM
Coil Bypass Factor	0.100
Fan Cycled for Cooling?	N Consider the Demonstration
Supply Air Reset	Greatest Demand
Maximum Reset Temperature:	65.0 F
HEATING SYSTEM DATA	37
Is Central Heating Used?	Y N
Fan Cycled for Heating?	= v
Supply Air Reset	Greatest Demand
Minimum Reset Temperature:	80.0 F
OUTDOOR VENTILATION DATA	Constant limfler Date
Type of Control	Constant Airflow Rate 100 %
Dampers Open During Unocc Per.:	Y
SUPPLY DUCT DATA	1
Duct Heat Gain:	0 %
Duct Leakage Rate	0 %
RETURN PLENUM DATA	V *0
Is a Return Plenum Used?	N
SUPPLY FAN DATA	••
Fan Type	Forward Curved
Configuration:	Draw-Thru
Fan kW:	3.7 kW
RETURN FAN DATA	
Fan Type:	None
OUTDOOR AIR ECONOMIZER	
Outdoor Economizer Type:	None
PREHEAT COIL	
Preheat Coil Used?	N
PRECOOL COIL	
Precool Coil Used?	N
HUMIDIFICATION	
Humidification System Used?	N
DEHUMIDIFICATION	•
Dehumidification System Used?	N
VENTILATION HEAT RECLAIM	
Reclaim Unit Type:	Sensible Only
Thermal Efficiency:	70 %
Device Power Usage:	0.1 kW
SAFETY FACTORS	
Sensible Cooling Factor:	0 %
Latent Cooling Factor:	0 %
Heating Factor	0 %

Name: AC-602, Work Corri Type: CONSTANT VOLUME - Prepared by: Keller & Ga ************************************	dor	gle :	7-3	R2B CA	V	****			**;	***	***	***	**	**		HA	P Pa	v3 ge	
3. ZONE DATA																			
ZONE T-Stat Occupied Cooling. Unoccupied Heating. Unoccupied Heating. Unoccupied Heating Throttling Range. Zone Heating Unit Type Trip Temperature Design Supply Temperat Fan Total Static(i Fan Efficiency Zone Terminal Type Reheat Coil Direct Exhaust Airflow Direct Exhaust Fan kW	g(g((ure(n.wg	(F): (F): (F): (F): (F): (F): (F): (F):		Spa	9: 5: ce fu:	1 8.0 5.0 8.0 5.0 3.0 BB - - N 0.0	(;	A1:	1 2	Zone	es	th	e	Sa	me				
HOURLY TSTAT SCHEDULES	<u></u>	000	000	0 0	0	0 0	=== 1	1	1	1 1	1	==: 1	1	 1	 1	_ <u></u> 2	 2	==- 2	2
	0 1	0 0	4 5	6	7	8 9	0	1	2	3 4	5	6	7	8	9	0	1	2	3
Design Day				X X X	X	X X X X	X	X	X	$\mathbf{x} \mid \mathbf{x}$: X	X	X	X	X	X	X		
Cooling Available During Unoccupied Period ? N																			
MONTHLY SCHEDULES	JAN	FEB	MAR	AI	?R	MAY	JU	ואו	JU	L A	UG	=== SI	EΡ	00	CT	NC	V	DF	EC
Space/Skin Heating Central Heating Central Cooling Vent Reclaim Unit	XXX	XXX	XXX	XX	XΧ	XXX XXX	xx	x	xx	x x	xx	xx	¢χ	XX XX	XX XX	XX	¢χ	XX	XX

1. SPACE SELECTION

Space Name ()ty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
25. 117-3: 3. Wrk Corr BL&R1 27. 117-3: 5. Cell 1 29. 117-3: 7. Cell 3 31. 117-3: 9. Cell 5 33. 117-3: 11. Breakdn Area	1 1 1 1 1	26. 117-3: 4. Inrt Stg E 28. 117-3: 6. Cell 2 30. 117-3: 8. Cell 4 32. 117-3: 10. Cell 6	L&R1 1 1 1 1 1 1 1

Name: HV-601 Mech Rm H&V Unit 117- Type: CONSTANT VOLUME - Single Zon Prepared by: Keller & Gannon **********************************	EM INPUT DATA 3 BL 11-08-94 e CAV HAP v3.06 Page 1 ************************************
1. SYSTEM NAME AND TYPE	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Name: HV-601 Mech Rm Type: CONSTANT VOLUM Number of Zones.: 1	H&V Unit 117-3 BL E - Single Zone CAV
2. SYSTEM DESCRIPTION	
COOLING SYSTEM DATA Is Central Cooling Used?	N
HEATING SYSTEM DATA Supply Air Temperature? Fan Cycled for Heating?	110.0 F N
Supply Air Reset OUTDOOR VENTILATION DATA Type of Control	Not Used Constant Airflow Rate
Design Ventilation Airflow: Dampers Open During Unocc Per.: SUPPLY DUCT DATA	4000.0 CFM Y
Duct Heat Gain	0 % 0 %
Is a Return Plenum Used? SUPPLY FAN DATA	N Forward Curved
Fan Type	Draw-Thru 3.0 kW
RETURN FAN DATA Fan Type OUTDOOR AIR ECONOMIZER	None
Outdoor Economizer Type: PREHEAT COIL Preheat Coil Used?	None N
PRECOOL COIL Precool Coil Used? HUMIDIFICATION	N
Humidification System Used? VENTILATION HEAT RECLAIM	N None
Reclaim Unit Type: SAFETY FACTORS Sensible Cooling Factor:	0 %
Latent Cooling Factor	0 % 0 %

Name: HV-601 Mech Rm H&V Type: CONSTANT VOLUME - Prepared by: Keller & Ga ************************************	Si	.ng	ſlε	11	7- on **	3 e **	CA	V	**	**	**	**	**	**	**	**	**	**	**		HA	P Pa	v3 qe	-94 .06 2 ***
3. ZONE DATA																								
ZONE T-Stat Occupied Cooling.	ig.	.(((() .(() e() ()	F) F) F) F) F) ***	: : : : : : : : : : : : : : : : : : : :	= ====		pa	12 6 6 ce 11	0. 0. 0. 3. F	000000000000000000000000000000000000000		Al	1	Zo	 ne	S	th	e	Sa	me)			
4. SCHEDULE DATA																								
HOURLY TSTAT SCHEDULES	0	0	0 2	0	0 4	0	0	07	0 8	0 9	1	1	1 2	1	1	1 5	1 6	17	1 8	1	2 0	2 1	2	2 3
Design Day Weekday Saturday Sunday							X X X	X X X	X X X	X X X	X X X	X X X	X X X	X	X	X	X	X	IXI	X	X X X	\mathbf{x}		
MONTHLY SCHEDULES	J2	N	FI	EB	MA	ıR	AI	PR	MA	Y	JU	N	Jι	ル	ΑU	IG	SE	P	00	T	NO	== V	DE	== C
Space/Skin Heating Central Heating	XX				XX								==				:==				XX XX			

Name: HV-601 Mech Rm H&V Uni Type: CONSTANT VOLUME - Sing Prepared by: Keller & Gannor	jle Zone C 1	AV	11-08-94 HAP v3.06 Page 1 ******
1. SPACE SELECTION			
Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
23. 117-3: 1. Mech Room	1		

AIR SY	STEM INPUT DATA	-						
Name: HV-601 Mech Rm H&V Unit 11	7-3 R1	11-08-9						
Type: CONSTANT VOLUME - Single Zo	one CAV	HAP v3.06						
Prepared by: Keller & Gannon **********************************		Page 1						
	***********	********						
1. SYSTEM NAME AND TYPE								
Name HV-601 Mech I Type CONSTANT VOLU	Rm H&V Unit 117-3 R1	~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~						
Number of Zones.: 1								
2. SYSTEM DESCRIPTION								
COOLING SYSTEM DATA								
Is Central Cooling Used? HEATING SYSTEM DATA	N							
Supply Air Temperature?	110.0 F							
Fan Cycled for Heating?	N							
Supply Air Reset Minimum Reset Temperature:	Greatest Demand							
OUTDOOR VENTILATION DATA	80.0 F							
Type of Control:	Constant Airflow Rate							
Design Ventilation Airflow:	4000.0 CFM							
Dampers Open During Unocc Per.:	Y							
SUPPLY DUCT DATA								
Duct Heat Gain	0 %							
Duct Leakage Rate RETURN PLENUM DATA	0 %							
Is a Return Plenum Used?	N							
SUPPLY FAN DATA	14							
Fan Type	Forward Curved							
Configuration	Draw-Thru							
Fan kw	3.0 kW							
RETURN FAN DATA Fan Type:	Nama							
OUTDOOR AIR ECONOMIZER	None							
Outdoor Economizer Type:	None							
PREHEAT COIL								
Preheat Coil Used?	N							
PRECOOL COIL								
Precool Coil Used?	N							
UMIDIFICATION Humidification System Hand	••							
Humidification System Used? VENTILATION HEAT RECLAIM	N							
Reclaim Unit Type	None							
AFETY FACTORS	140116							
Sensible Cooling Factor:	0 %							
Latent Cooling Factor:	0 %							
Heating Factor	0 %	•						

Name: HV-601 Mech Rm H&V Type: CONSTANT VOLUME - Prepared by: Keller & Ga ************************************	Uni Sing	t 11 le 2	7-3	CAV		****	***	****	***	****	HAP Pa	ige	.06 2
3. ZONE DATA													
ZONE T-Stat Occupied Cooling.	g. (((((((F): F): F): F): F): M):		12 5 4 pace 11	0.0	(A1	l Zo	nes	the	Same	2)		
4. SCHEDULE DATA									*===			===	
HOURLY TSTAT SCHEDULES	0 0	0 0 2 3	0 0 4 5	0 0 6 7	0 0 8 9	1 1 0 1	1 1 2 3	1 1 4 5	1 1 6 7	1 1 8 9	2 2 0 1	2 2	2 3
Design Day Weekday Saturday Sunday				X X X X X X	X X X X X X	X X X X	X X X X X X	X X X X X X	X X	X X	X X	:1 1	
MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	אטכ	JUL	AUG	SEP	OCT	NOV	DE	ic
Space/Skin Heating Central Heating				XXX							XXX		

Name: HV-601 Mech Rm H&V Unit Type: CONSTANT VOLUME - Sing Prepared by: Keller & Gannon **********************************	le Zone	CAV	11-08-94 HAP v3.06 Page 1
1. SPACE SELECTION		~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~	
Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
23. 117-3: 1. Mech Room	1		

AIR SYS Name: AC-1001 Work Room 117-5 BAS	STEM INPUT DATA	11-09-0					
Type: CONSTANT VOLUME - Single Zo		11-08-9 HAP v3.0					
Prepared by: Keller & Gannon	ine CAV	Page					
*********	******	*****					
1. SYSTEM NAME AND TYPE							
Name AC-1001 Work	Room 117-5 BASELINE						
Type CONSTANT VOLU	ME - Single Zone CAV						
Number of Zones.: 1							
2. SYSTEM DESCRIPTION							
COOLING SYSTEM DATA	••						
Is Central Cooling Used?	Y						
Supply Air:	9500.0 CFM						
Coil Bypass Factor	0.100						
Fan Cycled for Cooling?	N						
Supply Air Reset	Not Used						
HEATING SYSTEM DATA							
Is Central Heating Used?	Y						
Fan Cycled for Heating?	N						
Supply Air Reset:	Not Used						
OUTDOOR VENTILATION DATA							
Type of Control	Constant Airflow Rate						
Design Ventilation Airflow:	100 %						
Dampers Open During Unocc Per.:	Y						
SUPPLY DUCT DATA	2 0						
Duct Heat Gain	0 %						
Duct Leakage Rate:	0 %						
RETURN PLENUM DATA	V						
Is a Return Plenum Used?	N						
SUPPLY FAN DATA	Formand Curried						
Fan Type	Forward Curved Draw-Thru						
Fan kw	5.6 kW						
RETURN FAN DATA	3.0 KW						
Fan Type:	None						
OUTDOOR AIR ECONOMIZER	None						
Outdoor Economizer Type:	None						
PREHEAT COIL	None						
Preheat Coil Used?	N						
PRECOOL COIL	N						
Precool Coil Used?	N						
HUMIDIFICATION	N						
Humidification System Used?	N						
DEHUMIDIFICATION	N						
Dehumidification System Used?	N						
VENTILATION HEAT RECLAIM	17	•					
Reclaim Unit Type:	None						
SAFETY FACTORS	HOHE						
Sensible Cooling Factor:	0 %						
Latent Cooling Factor	0 %						
Heating Factor	0 %						

Name: AC-1001 Work Room 117-5 Type: CONSTANT VOLUME - Single Prepared by: Keller & Gannon **********************************	*****	11-08-94 HAP v3.06 Page 2 *******	
3. ZONE DATA			
ZONE T-Stat Occupied Cooling(F) Unoccupied Cooling(F) Occupied Heating(F) Unoccupied Heating(F) Throttling Range(F) Zone Heating Unit Type Trip Temperature(F) Design Supply Temperature(F) Fan Total Static(in.wg.) Fan Efficiency(%) Zone Terminal Type(%) Reheat Coil Direct Exhaust Airflow(CFM) Direct Exhaust Fan kw(kw):	7 7 7 7 No	5.0 5.0 5.0 5.0 3.0 one - -	es the Same)
4. SCHEDULE DATA			
HOURLY TSTAT SCHEDULES 0000 012	0 0 0 0 0 0 3 4 5 6 7	0 0 1 1 1 1 1 1 8 9 0 1 2 3 4	1 1 1 1 1 1 2 2 2 2 2 1 5 6 7 8 9 0 1 2 3
Design Day		XXXXXXXXXX	
Cooling Available During Unoccu	pied Peric	d? N	
MONTHLY SCHEDULES JAN FE	B MAR APR	MAY JUN JUL A	UG SEP OCT NOV DEC
Central Heating XXX XX Central Cooling	x xxx xxx	xxx xxx xxx xxx x	xx xxx xxx xxx xxx

Name: AC-1001 Work Room 117- Type: CONSTANT VOLUME - Since Prepared by: Keller & Gannon **********************************	gle Zone Ci n	AV	11-08-94 HAP V3.06 Page 1
1. SPACE SELECTION			
Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
38. 117-5: 1. Work Rm BL	§R1 1		

Name: AC-1001 Work Room 117-5 R1 Type: CONSTANT VOLUME - Single Zo Prepared by: Keller & Gannon	TIEM INPUT DATA 11-08-94 Ine CAV Page 1 ***********************************
1. SYSTEM NAME AND TYPE	
Name: AC-1001 Work Type: CONSTANT VOLU Number of Zones.: 1	Room 117-5 R1 ME - Single Zone CAV
2. SYSTEM DESCRIPTION	
COOLING SYSTEM DATA Is Central Cooling Used? Supply Air Coil Bypass Factor Fan Cycled for Cooling? Supply Air Reset Maximum Reset Temperature HEATING SYSTEM DATA Is Central Heating Used? Fan Cycled for Heating? Supply Air Reset Minimum Reset Temperature OUTDOOR VENTILATION DATA Type of Control Design Ventilation Airflow Dampers Open During Unocc Per.:	Y 9500.0 CFM 0.100 N Greatest Demand 65.0 F Y N Greatest Demand 90.0 F Constant Airflow Rate 100 % Y
SUPPLY DUCT DATA Euct Heat Gain Duct Leakage Rate RETURN PLENUM DATA	0 % 0 %
Is a Return Plenum Used? SUPPLY FAN DATA Fan Type Configuration Fan kW RETURN FAN DATA	N Forward Curved Draw-Thru 5.6 kW
Fan TypeOUTDOOR AIR ECONOMIZER	None
Outdoor Economizer Type: PREHEAT COIL Preheat Coil Used?	None N
PRECOOL COIL Precool Coil Used?	N
HUMIDIFICATION Humidification System Used? DEHUMIDIFICATION	N
Dehumidification System Used? VENTILATION HEAT RECLAIM Reclaim Unit Type	N None
Sensible Cooling Factor: Latent Cooling Factor Heating Factor	0 % 0 % 0 %

AIR SYSTEM INPUT DATA Name: AC-1001 Work Room 117-5 R1 Type: CONSTANT VOLUME - Single Zone CAV Prepared by: Keller & Gannon **********************************									**	***	**:		HAI I	v ag	e	06 2
3. ZONE DATA																
ZONE					1	(Al	.1 2	one	s	the	Sa	ame)			
T-Stat Occupied Cooling	. (F):			78		•							•			
Unoccupied Cooling.				85												
Occupied Heating				68												
Unoccupied Heating.				55												
Throttling Range Zone Heating Unit Type				No	. 0											
Trip Temperature				1401	-											
Design Supply Temperatur					_											
Fan Total Static(in.					_											
Fan Efficiency					-											
Zone Terminal Type			Dif	fuse												
Reheat Coil				_	N											
Direct Exhaust Airflow(_	. 0											
Direct Exhaust Fan kW	(KW):				. 0 											
																_
4. SCHEDULE DATA					===:											
HOURLY TSTAT SCHEDULES 0	10101	0 0	00		0 0	111	111	1 1	11	11	1 1	1	2	2 :	2 2	:1
0	0 0 1 2	3 4	5 6	7 8	3 9	0 1	2	3 4	5	6	7 8	9	0	1 :	2 3	.
					·	<u></u> -		-÷-			- <u>-</u> -	÷	<u>-</u>	-÷.	-÷-	÷
Design Day			X			XX									-	
Weekday			X		X	XX	X	XX	X	X	XX	X	X	X	j	1
SaturdaySunday			Х	X X	` ^	x x	^	^ ^	^	^ -	^ ^	^	^	^		
======================================		_		[====	<u> </u>		<u> </u>		<u> </u>	 	- <u> </u>		 ===	_ <u> </u>		_
Cooling Available During Un	noccu	pied	l Pe	riod	?	N										
MONTHLY SCHEDULES JA	AN FE	B M.	R A	PR M	AY	JUN	טע	L A	JG	SEI	9 0	CT	NO	v [EC	Ī
Central Heating XX	XX XX	x x	x x	x x	XX			1			x	XX	XX	x x	XXX	Ĺ
Central Cooling						XXX	XX	x x	ĸΧ	XXX						
	-===	====	====	====	===			====	===	===	===	===	===	===	===	=

Name: AC-1001 Work Room 117- Type: CONSTANT VOLUME - Sing Prepared by: Keller & Gannon **********************************	le Zone C		11-08-94 HAP v3.06 Page 1
1. SPACE SELECTION			
Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
38. 117-5: 1. Work Rm BL&F	R1 1		

11-08-94 Name: AC-1001 Work Room 117-5 R2 HAP v3.06 Type: CONSTANT VOLUME - Single Zone CAV Page 1 Prepared by: Keller & Gannon **************** 1. SYSTEM NAME AND TYPE Name..... AC-1001 Work Room 117-5 R2 Type..... CONSTANT VOLUME - Single Zone CAV Number of Zones.: 1 2. SYSTEM DESCRIPTION COOLING SYSTEM DATA Y Is Central Cooling Used.....? 9500.0 CFM Supply Air....: Coil Bypass Factor....: 0.100 Fan Cycled for Cooling....? N Greatest Demand Supply Air Reset..... 65.0 F Maximum Reset Temperature....: HEATING SYSTEM DATA Y Is Central Heating Used....? N Fan Cycled for Heating....? Supply Air Reset....: Greatest Demand 80.0 F Minimum Reset Temperature....: OUTDOOR VENTILATION DATA Constant Airflow Rate Type of Control....: 100 % Design Ventilation Airflow...: Y Dampers Open During Unocc Per.: SUPPLY DUCT DATA 0 % Duct Heat Gain....: 0 % Duct Leakage Rate....: RETURN PLENUM DATA Is a Return Plenum Used.....? N SUPPLY FAN DATA Forward Curved Fan Type....: Draw-Thru Configuration....: Fan kw....: 7.1 kW RETURN FAN DATA None Fan Type....: OUTDOOR AIR ECONOMIZER Outdoor Economizer Type....: None PREHEAT COIL N Preheat Coil Used....? PRECOOL COIL Precool Coil Used....? N HUMIDIFICATION Humidification System Used....? N DEHUMIDIFICATION N Dehumidification System Used..? VENTILATION HEAT RECLAIM Reclaim Unit Type....: None SAFETY FACTORS Sensible Cooling Factor....: 0 % 0 % Latent Cooling Factor....: 0 % Heating Factor....

Name: AC-1001 Work Room Type: CONSTANT VOLUME - Prepared by: Keller & Ga ************************************	Single nnon	Zone	CAV	****	*****	****		HAP Pag	08-94 v3.06 ge 2 ****
3. ZONE DATA									
ZONE T-Stat Occupied Cooling.	g. (F):(F): g. (F):(F):(F): ure(F): n.wg.):(%):		78.0 85.0 68.0 55.0 None		l Zone	s the	Same)	
4. SCHEDULE DATA									
HOURLY TSTAT SCHEDULES	0 0 0 0 0 0 0 1 2 0 1	0 0 0 3 4 5	0 0 0 0 6 7 8	0 1 1 9 0 1	1 1 1 2 3 4	1 1 5 6	1 1 1 7 8 9	2 2 0 1	2 2 2 3
Design Day			X X X X X X X X X X X X X X X X X X X	X X X X	X X X	XXX	X X X X	X X	
Cooling Available During	Unoccup	pied	Period	? И				====	
MONTHLY SCHEDULES	JAN FEI	3 MAR	APR MA	ן אטכן צ	JUL AU	JG SEI	POCT	NOV	DEC
Central Heating	XXX XXX	xxx	XXX XX		xxx x	xx xx	xxx xxx	xxx	xxx

Name: AC-1001 Work Room 117-5 Type: CONSTANT VOLUME - Singl Prepared by: Keller & Gannon **********************************	e Zone C		11-08-94 HAP v3.06 Page 1
1. SPACE SELECTION Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
45. 117-5: 1. Work Rm R2&3	1		

Name: AC-1001 Work Room 117-5 R3 11-08-94 Type: CONSTANT VOLUME - Single Zone CAV HAP v3.06 Prepared by: Keller & Gannon Page 1 ***************** 1. SYSTEM NAME AND TYPE Name..... AC-1001 Work Room 117-5 R3 Type..... CONSTANT VOLUME - Single Zone CAV Number of Zones.: 1 2. SYSTEM DESCRIPTION COOLING SYSTEM DATA Is Central Cooling Used.....? 9500.0 CFM Supply Air....: Coil Bypass Factor....: 0.100 Fan Cycled for Cooling.....? Supply Air Reset....: Greatest Demand Maximum Reset Temperature....: 65.0 F HEATING SYSTEM DATA Is Central Heating Used.....? Y Fan Cycled for Heating....? N Supply Air Reset....: Greatest Demand Minimum Reset Temperature....: 80.0 F OUTDOOR VENTILATION DATA Type of Control....: Constant Airflow Rate Design Ventilation Airflow...: 100 % Dampers Open During Unocc Per.: Y SUPPLY DUCT DATA Duct Heat Gain....: 0 % Duct Leakage Rate....: 0 % RETURN PLENUM DATA Is a Return Plenum Used.....? N SUPPLY FAN DATA Fan Type....: Forward Curved Configuration....: Draw-Thru Fan kW.....: 7.1 kW RETURN FAN DATA Fan Type....: None OUTDOOR AIR ECONOMIZER Outdoor Economizer Type....: None PREHEAT COIL Preheat Coil Used....? N PRECOOL COIL Precool Coil Used....? N HUMIDIFICATION Humidification System Used....? N DEHUMIDIFICATION Dehumidification System Used..? N VENTILATION HEAT RECLAIM Reclaim Unit Type....: Sensible Only Thermal Efficiency....: 70 % Device Power Usage....: 0.2 kW SAFETY FACTORS Sensible Cooling Factor....: 0 % Latent Cooling Factor....: 0 % Heating Factor....: 0 %

Name: AC-1001 Work Room Type: CONSTANT VOLUME - Prepared by: Keller & Ga	117-5 R3 Single Zond annon			11-08-9 HAP v3.00 Page :			
3. ZONE DATA							
ZONE T-Stat Occupied Cooling. Unoccupied Heating. Unoccupied Heating. Unoccupied Heating Throttling Range. Zone Heating Unit Type. Trip Temperature Design Supply Temperat Fan Total Static(i Fan Efficiency Zone Terminal Type Reheat Coil Direct Exhaust Airflow Direct Exhaust Fan kW	ag(F):(F):(F):(F):(F):(F):(F):(F):(*):(*):(*):	1 (2 78.0 85.0 68.0 55.0 3.0 None - - - Diffuser N 0.0 0.0	All Zones	the Same)			
4. SCHEDULE DATA							
HOURLY TSTAT SCHEDULES	0 0 0 0 0 0 0 1 2 3 4	0 0 0 0 0 0 1 5 6 7 8 9 0	$\begin{vmatrix} 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & 2 & 3 & 4 & 5 \end{vmatrix}$	1 1 1 1 2 2 2 2 2 6 7 8 9 0 1 2 3			
Design Day Weekday Saturday Sunday				X			
Cooling Available During Unoccupied Period ? N							
MONTHLY SCHEDULES	JAN FEB MA	R APR MAY JU	JUL AUG	SEP OCT NOV DEC			
Central Heating Central Cooling Vent Reclaim Unit	xxx xxx xx		xx xxx xxx	XXX XXX XXX XXX XXX			

AIR	SYSTEM	INPUT	DATA

Name: AC-1001 Work Room 117-5 Type: CONSTANT VOLUME - Single Prepared by: Keller & Gannon **********************************	R3 .e Zone		11-08-94 HAP v3.06 Page 1
1. SPACE SELECTION			
Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			========
45. 117-5: 1. Work Rm R2&3	1		

ATD SUSTEM INDITED DATA

AIR SYST	EM INPUT DATA
Name: AC-1002 Mech Rm & WCs 117-5 1	
Type: CONSTANT VOLUME - Multizone	HAP v3.06
Prenared by: Keller & Gannon	Page 1
**********	************
1. SYSTEM NAME AND TYPE	
Name AC-1002 Mech Rr	m & WCs 117-5 BL
Type CONSTANT VOLUM	E - Multizone
Number of Zones.: 2	
2. SYSTEM DESCRIPTION	
COOLING SYSTEM DATA	0F 0 F
Cold Deck Temperature:	85.0 F
Coil Bypass Factor	0.100
Cold Deck Reset	Not Used
HEATING SYSTEM DATA	
Hot Deck Temperature:	70.0 F
Hot Deck Reset	Not Used
OUTDOOR VENTILATION DATA	a 1 1 2 2 62 cc Date
Type of Control	Constant Airflow Rate
Design Ventilation Airflow:	100 %
Dampers Open During Unocc Per.:	Y
SUPPLY DUCT DATA	
Duct Heat Gain:	0 %
Duct Leakage Rate:	0 %
RETURN PLENUM DATA	••
Is a Return Plenum Used?	N
SUPPLY FAN DATA	
Fan Type	Forward Curved
Fan kw	3.7 kW
RETURN FAN DATA	
Fan Type:	None
OUTDOOR AIR ECONOMIZER	••
Outdoor Economizer Type:	None
PREHEAT COIL	
Preheat Coil Used?	N
PRECOOL COIL	
Precool Coil Used?	N
VENTILATION HEAT RECLAIM	
Reclaim Unit Type	None
SAFETY FACTORS	
Sensible Cooling Factor:	0 %
Latent Cooling Factor:	0 %
Heating Factor	0 %

Name: AC-1002 Mech Rm & WCs 117-5 Type: CONSTANT VOLUME - Multizone Prepared by: Keller & Gannon **********************************	2	*****	11-08-94 HAP v3.06 Page 2 ******
3. ZONE DATA			
ZONE T-Stat Occupied Cooling(F): Unoccupied Cooling(F): Occupied Heating(F): Unoccupied Heating(F): Throttling Range(F): Zone Heating Unit Type: Trip Temperature(F): Design Supply Temperature(F): Fan Total Static(in.wg.): Fan Efficiency(%): Zone Terminal Type Reheat Coil? Diversity Factor(%): Direct Exhaust Airflow(CFM): Direct Exhaust Fan kW(kW):	1 90.0 120.0 55.0 55.0 3.0 None CAV MBox N 100 0.0 0.0	2 90.0 120.0 69.0 69.0 3.0 Space FC - 136.0 0.25 54 CAV MBox N 100 580.0 0.1	
4. SCHEDULE DATA			
HOURLY TSTAT SCHEDULES 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 4 5 6 7 8 9	1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 2 2 2 2 2 3 6 7 8 9 0 1 2 3
Design Day	X X X X X X X X X X X X X X X X X X X	X X X X X X X X X X	
Cooling Available During Unoccupio	ed Period ?	Y	
MONTHLY SCHEDULES JAN FEB 1	MAR APR MAY	JUN JUL AUG	SEP OCT NOV DEC
			XXX XXX XXX XXX XXX

Name: AC-1002 Mech Rm & WCs 11 Type: CONSTANT VOLUME - Multiz Prepared by: Keller & Gannon **********************************	one	*******	11-08-94 HAP v3.06 Page 1
1. SPACE SELECTION			
Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
39. 117-5: 3. Mechanical Rm	1		
SPACES IN ZONE 2 (Zone 2)			
40. 117-5: 4. Corridor 42. 117-5: 6. Men's Toilet 44. 117-5: Wk/Mch Rm Plenum	1	41. 117-5: 5. Janitor Ro 43. 117-5: 7. Women's WO	

	TEM INPUT DATA
Name: AC-1002 Mech & WC 117-5 R1	
Type: CONSTANT VOLUME - Multizone	HAP v3.06
Prepared by: Keller & Gannon	Page 1
**********	***********
1. SYSTEM NAME AND TYPE	
17-w	
Name AC-1002 Mech 8	
Type CONSTANT VOLUM	ME - MUITIZONE
Number of Zones: 2	
2. SYSTEM DESCRIPTION	
COOLING SYSTEM DATA	
Cold Deck Temperature:	85.0 F
Coil Bypass Factor	0.100
Cold Deck Reset	Not Used
HEATING SYSTEM DATA	Not obed
Hot Deck Temperature:	70.0 F
Hot Deck Reset	Greatest Demand
Minimum Reset Temperature:	60.0 F
OUTDOOR VENTILATION DATA	
Type of Control:	Constant Airflow Rate
Design Ventilation Airflow:	100 %
Dampers Open During Unocc Per.:	Y
SUPPLY DUCT DATA	-
Duct Heat Gain:	0 %
Duct Leakage Rate:	0 %
RETURN PLENUM DATA	
Is a Return Plenum Used?	N
SUPPLY FAN DATA	
Fan Type:	Forward Curved
Fan kw:	3.7 kW
RETURN FAN DATA	
Fan Type	None
OUTDOOR AIR ECONOMIZER	
Outdoor Economizer Type:	None
PREHEAT COIL	
Preheat Coil Used?	N
PRECOOL COIL	••
Precool Coil Used?	N
VENTILATION HEAT RECLAIM	Van -
Reclaim Unit Type:	None
SAFETY FACTORS	۸ ه
Sensible Cooling Factor:	0 %
Latent Cooling Factor	0 % 0 %
Heating Factor	U -6

Name: AC-1002 Mech & WC Type: CONSTANT VOLUME - Prepared by: Keller & Ga	117- Mult nnor	iz	R1	e &	R	2						**	k *	**	**	**	**	**		HAI	à	ge	06 2
3. ZONE DATA																							
ZONE T-Stat Occupied Cooling.	(cr	F) F) F) F) ** ** ** ** ** ** ** ** ** ** ** ** **			C2		12 5 4 N	0.0 5.0 5.0 one	0000 = × 1000	-	; ; ;	L36 0. ME	F(5.0)	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0									
4. SCHEDULE DATA																							
HOURLY TSTAT SCHEDULES		0 2	0	0 4	0	0	07	0 8	0	1 0	1	1 2	1	1 4	1 5	1 6	17	1 8	1 9	2 0	2	2	2 3
Design Day Weekday Saturday Sunday						X X X	X	X	X	X	X	X	X	X	X	X	X	X	X	X X X	XΙ		
Cooling Available During	Uno	ccu	ıp:	ied	i F	Pe1	cio	od	?	Y	?												
MONTHLY SCHEDULES	JAN	FE	B	MZ	\R	ΑI	?R	MA	Y	Jτ	ן אנ	Jυ	Ιļ	ΑÜ	īG	SI	P	oc	T	NO	v	DE	cl
Space/Skin Heating Central Heating Central Cooling	XXX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX XX XX	XX	X	XX	$ \mathbf{X} $	XX	X	XX	XX	XX XX	X X	XX XX	X X

Name: AC-1002 Mech & WC 117-5 Type: CONSTANT VOLUME - Multi Prepared by: Keller & Gannon **********************************	zone	_	11-08-94 HAP v3.06 Page 1
1. SPACE SELECTION			
Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
39. 117-5: 3. Mechanical Rm	1		
SPACES IN ZONE 2 (Zone 2)		=======================================	=======
40. 117-5: 4. Corridor 42. 117-5: 6. Men's Toilet		41. 117-5: 5. Janitor Ro 43. 117-5: 7. Women's WC	
44. 117-5: Wk/Mch Rm Plenum		43. II/-3. /. Women's wc	1

	EM INPUT DATA	11-08-94
Name: AC-1002 Mech & WC 117-5 R3		HAP v3.06
Type: CONSTANT VOLUME - Multizone		Page 1
Prepared by: Keller & Gannon **********************************	*******	****

1. SYSTEM NAME AND TYPE		
1. SISIEM NAME AND TITE		
Name AC-1002 Mech &	WC 117-5 R3	
Type CONSTANT VOLUM	E - Multizone	
Number of Zones: 2		
2. SYSTEM DESCRIPTION		
COOLING SYSTEM DATA		
Cold Deck Temperature:	85.0 F	
Coil Bypass Factor	0.100	
Cold Deck Reset	Not Used	
HEATING SYSTEM DATA		
Hot Deck Temperature:	70.0 F	
Hot Deck Reset	Greatest Demand	
Minimum Reset Temperature:	60.0 F	
OUTDOOR VENTILATION DATA	n I I a luca an Daha	
Type of Control	Constant Airflow Rate	
Design Ventilation Airflow:	100 %	
Dampers Open During Unocc Per.:	Y	
SUPPLY DUCT DATA	0 %	
Duct Heat Gain	0 % 0 %	
Duct Leakage Rate:	0 %	
RETURN PLENUM DATA Is a Return Plenum Used?	N	
	N	
SUPPLY FAN DATA Fan Type:	Forward Curved	
Fan kW	3.7 kW	
RETURN FAN DATA		
Fan Type	None	
OUTDOOR AIR ECONOMIZER	•	
Outdoor Economizer Type:	None	
PREHEAT COIL		
Preheat Coil Used?	N	
PRECOOL COIL		
Precool Coil Used?	N	
VENTILATION HEAT RECLAIM		
Reclaim Unit Type:	Sensible Only	
Thermal Efficiency	70 %	
Device Power Usage:	0.2 kW	
SAFETY FACTORS		
Sensible Cooling Factor:	0 %	
Latent Cooling Factor:	0 %	
Heating Factor	0 %	

Name: AC-1002 Mech & WC 117-5 R3 Type: CONSTANT VOLUME - Multizon Prepared by: Keller & Gannon **********************************	e	*****	11-08-94 HAP v3.06 Page 2					
3. ZONE DATA								
ZONE	1	2						
T-Stat Occupied Cooling(F):	90.0	90.0						
Unoccupied Cooling(F): Occupied Heating(F):	120.0 55.0	120.0 68.0						
Unoccupied Heating(F):	45.0	55.0						
Throttling Range(F):	3.0	3.0						
Zone Heating Unit Type	None	Space FC						
Trip Temperature(F): Design Supply Temperature(F):		136.0						
Fan Total Static(in.wg.):	-	0.00						
Fan Efficiency(%):	· -	54						
Zone Terminal Type	CAV MBox	CAV MBox						
Reheat Coil?	N	N						
Diversity Factor(%): Direct Exhaust Airflow(CFM):	100	100 580.0						
Direct Exhaust Fan kW(kW):	0.0	0.1						
=======================================								
4. SCHEDULE DATA								
HOURLY TSTAT SCHEDULES 0 0 0 0 0 0 0 1 2 3	0 0 0 0 0 0 0 4 5 6 7 8 9	0 1 1 1 1 1 1 1 1 0 0 1 1 2 3 4	1 1 1 1 2 2 2 2 5 6 7 8 9 0 1 2 3					
Design Day	x x x	IXIXIXIXIX	x x x x x x					
Weekday	XXXX	XXXXX						
Saturday	X X X X		x					
Sunday	1 1 1 1	1 1 1 1 1	<u> </u>					
Cooling Available During Unoccupied Period ? Y								
MONTHLY SCHEDULES JAN FEB	MAR APR MAY	JUN JUL AUC	G SEP OCT NOV DEC					
			x xxx xxx xxx xxx					
Central Heating XXX XXX Central Cooling	xxx xxx xxx		X XXX XXX XXX XXX					
	xxx xxx xxx	XXX XXX XX	xxx xxx xxx xxx					

Name: AC-1002 Mech & WC 117-5 Type: CONSTANT VOLUME - Multi Prepared by: Keller & Gannon **********************************	zone	*****	*****	11-08-94 HAP v3.06 Page 1
1. SPACE SELECTION				
Space Name	Qty	Space N	ame	Qty
SPACES IN ZONE 1 (Zone 1)				
39. 117-5: 3. Mechanical R	m 1			
SPACES IN ZONE 2 (Zone 2)				
40. 117-5: 4. Corridor 42. 117-5: 6. Men's Toilet 44. 117-5: Wk/Mch Rm Plenu		41. 117-5: 43. 117-5:	5. Janitor : 7. Women's	

PLANT INP Plant: Srvcs&Surt ACTUAL Cooler BL Prepared By: Keller & Gannon **********************************		*****	12-20-94 Page 1
PLANT NAME, CLASSIFICATION & TYPE			
Plant name	g oled DX	Cooler BL	
AIR SYSTEM SELECTIONS			
Air System Name	Туре	Quantity	
2. UH-701. 2 Htrs,117-1 Mech Rm BL 5. AC-701 ACTUAL Conditns,117-1 B	(2P-FC) L. (DD CAV)	1 1	
AIR-COOLED DX COOLING DATA			
COOLING DATA Estimated maximum cooling load: Design OAT	NA 97.0 F 25.0 Tons 34.0 kW 3.0 kW 0.000 kW 0.150 40.0 F		

Plant: Services & Support Prepared By: Keller & Control	ort Bdg	Heating		_	*****	12-20-94 Page 1 ******
PLANT NAME, CLASSIFICA	TION & T	YPE				
Plant name Classification Type Notes Notes		: Heati : Steam : Remot	ng Boiler e source	is the 1	Boiler Pl	ant 117-2
AIR SYSTEM SELECTIONS						
Air System Name			He Pre-Heat	ating Coi Central	il Catego: L Termina	ry al Zone
1. AC-701 117-1 2. UH-701. 2 Htrs,117				1 1	-	- - -
STEAM BOILER DATA						
Estimated maximum hea Gross output at design Energy input at design Overall efficiency at Fuel or energy type Combustion air blower Fuel oil pump kw	m m design kw	•••••	16378.0 60.0 Fuel Oil 2.000	MBH MBH %		
BOILER PART-LOAD PERF	ORMANCE	DATA				
<pre>% Load Overall Eff.</pre>	(%)	Load	Overall			
90 60.0 80 60.0 70 60.0 60 60.0 50 60.0		40 30 20 10 0	60 60	0.0 0.0 0.0 0.0		
PUMP AND PIPING SYSTEM	DATA					
Pump or Piping System	Delta-T (F)	Pump Head (ft wg)	l Mech	encies Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Steam				-	-	0.0

3. Anex Fan&Elec Htg Coil, 117-1 BL. 1 - - -

Plant: Srvcs&Surt ACTUAL Cooler R1 Prepared By: Keller & Gannon **********************************	*****	*****	12-20-94 Page 1
PLANT NAME, CLASSIFICATION & TYPE			
Plant name: Srvcs&Suclassification: Cooling Type	led DX	Cooler R1	
AIR SYSTEM SELECTIONS			
Air System Name	Туре	Quantity	
14. UH-701. 2 Htrs,117-1 Mech Rm R1 15. AC-701 ACTUAL Conditns,117-1 R1.			
AIR-COOLED DX COOLING DATA			
COOLING DATA Estimated maximum cooling load: Design OAT	NA 97.0 F 25.0 Tons 34.0 kW 3.0 kW 0.000 kW 0.150 40.0 F		

Plant: Srvcs & Spprt B	dg Heating R:	INPUT DATA L			12-20-94
Prepared By: Keller & ***********	Gannon *******	*****	*****	****	Page 1
PLANT NAME, CLASSIFICA	TION & TYPE				
Plant name	Hea	ating : Water Boi mote source	ler is the Bo	iler Pla	
AIR SYSTEM SELECTIONS					
Air System Name		He Pre-Heat	ating Coil Central	Categor Termina	y 1 Zone
14. UH-701. 2 Htrs,11 15. AC-701 ACTUAL Co	7-1 Mech Rm F nditns,117-1	R1	1 1	- - -	- -
HOT WATER BOILER DATA					
Estimated maximum he Gross output at desi Energy input at desi Overall efficiency a Fuel or energy type. Combustion air blower Fuel oil pump kW	gn t design r kW	: 16378.0 : 55.0 : Fuel Oil : 0.200	MBH % kW		
BOILER PART-LOAD PER	FORMANCE DATA				
% Load Overall Eff.			Eff. (%)		
90 55.0 80 55.0 70 55.0 60 55.0 50 55.0	3 2 1	0 55 0 55 0 55 0 55	5.0 5.0		
PUMP AND PIPING SYSTEM	DATA		• • • • • • • • • • • • • • • • • • •		
Pump or Piping System		ump Effici ead Mech wg) (%)	Elec	Pump Power (kW)	Piping Gain/Loss (%)
Hot Water	237.8 20	.00 85.0	90.0	0.37	2.0

Plant: Srvcs & Spprt E Prepared By: Keller &	dg Heatin Gannon	g BL	PUT DATA		****	12-20-94 Page 1
PLANT NAME, CLASSIFICA	TION & TY	PE				
Plant name		Heating Hot Wa Remote	ng ater Boi e source	ler is the :	Boiler Pl	
AIR SYSTEM SELECTIONS						
Air System Name]			il Catego l Termina	
2. UH-701. 2 Htrs,11 5. AC-701 ACTUAL Co				1	-	<u>-</u> -
HOT WATER BOILER DATA Estimated maximum he Gross output at desi Energy input at desi Overall efficiency a Fuel or energy type. Combustion air blowe Fuel oil pump kw	gngnt design.	· · · · · · · · · · · · · · · · · · ·	NA 9007.9 16378.0 55.0 Fuel Oil 0.200 0.050	MBH MBH %		
BOILER PART-LOAD PER	FORMANCE	DATA				
<pre>% Load Overall Eff.</pre>	(%) %	Load	Overall	Eff. (%)		
90 55.0 80 55.0 70 55.0 60 55.0 50 55.0		40 30 20 10 0	55 55 55	5.0 5.0 5.0 5.0		
PUMP AND PIPING SYSTEM	DATA					
Pump or Piping System	Delta-T (F)	Pump Head (ft wg)	Mech	encies Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Hot Water	237.8	20.00	85.0	90.0	0.37	2.0

PLANT INP Plant: 117-3 CA-601 A/C DX Cooling BL Prepared By: Keller & Gannon **********************************		*****	12-20-94 Page 1 ******
PLANT NAME, CLASSIFICATION & TYPE			
Plant name	CA-601 A/C DX g oled DX er-Generated	Cooling BL	
AIR SYSTEM SELECTIONS			
Air System Name	Туре		
6. AC-601, Control Room, 117-3 BL	. (SZ CAV)	1	
AIR-COOLED DX COOLING DATA			
Outdoor fan power at design:	NA 97.0 F 5.0 Tons 6.5 kW 0.1 kW 0.000 kW 0.150 55.0 F N		

**********	Gannon *******	*****	*****	*****	12-20-9 Page ******
PLANT NAME, CLASSIFICA	ATION & TYPE				
Plant name Classification Type Notes	Hea Hot	ting Water Boi ote source	ler is the Bo	iler Pla	ant 117-2 Rm @ 15psi
AIR SYSTEM SELECTIONS					
Air System Name		Heat Pre-Heat	ating Coil Central	Categor Termina	y al Zone
6. AC-601, Control R	oom, 117-3 BL		1	-	1
HOT WATER BOILER DATA					
Estimated maximum he Gross output at desi Energy input at desi Overall efficiency a Fuel or energy type. Combustion air blower Fuel oil pump kw	gngngnt designr	9007.9 16378.0 55.0 Fuel Oil 0.200	MBH %		
orr bamb va	• • • • • • • • • • • • • •	0.050	kW		
BOILER PART-LOAD PER		0.050			
	FORMANCE DATA		Eff. (%)		
BOILER PART-LOAD PER	FORMANCE DATA	0 0verall 55 55 55	Eff. (%) .0 .0 .0		
BOILER PART-LOAD PER % Load Overall Eff. 90 55.0 80 55.0 70 55.0 60 55.0 50 55.0	FORMANCE DATA (%) % Load 40 30 20	0 0verall 55 55 55 55	Eff. (%) .0 .0 .0		
BOILER PART-LOAD PER % Load Overall Eff. 90 55.0 80 55.0 70 55.0 60 55.0 50 55.0	FORMANCE DATA (%) % Load 40 30 20 10 0 DATA Pu Delta-T He	Overall 55 55 55 55	Eff. (%) .0 .0 .0 .0 .0		

Plant: 117-3 CA-601 A/C DX Cooling R1 Prepared By: Keller & Gannon **********************************		*****	12-20-94 Page 1
PLANT NAME, CLASSIFICATION & TYPE			
Plant name	g oled DX	Cooling R1	
AIR SYSTEM SELECTIONS			
Air System Name	Type	Quantity	
16. AC-601, Control Room, 117-3 R1.			
AIR-COOLED DX COOLING DATA			
COOLING DATA Estimated maximum cooling load: Design OAT	NA 97.0 F 5.0 Tons 6.5 kW 0.1 kW 0.000 kW 0.150 55.0 F N		

Plant: 117-3 S Prepared By: I	Keller &	ol AC-601 Gannon			****	****	12-20-94 Page 1 *****
PLANT NAME, CI	LASSIFICA	r & noit	YPE				
Plant name Classificati Type Notes Notes	lon		: Heatin : Hot Wa : Remote	g ter Boil source	ler is the Bo	oiler Pla	nt 117-2 m @ 15psi
AIR SYSTEM SEI	ECTIONS						
Air Syste				re-Heat	ting Coil Central	Termina	l Zone
16. AC-601, C	control R	oom, 117	-3 R1	-	1	-	1
HOT WATER BOIL							
Estimated ma Gross output Energy input Overall effi Fuel or ener Combustion a Fuel oil pum	at design ciency agy gy type. ir blower	gn t design r kW	F	16378.0 55.0 uel Oil 0.200	MBH % kw		
BOILER PART-	LOAD PER	FORMANCE	DATA				
% Load Over	all Eff.	(%)	% Load (Overall	Eff. (%)		* ***
	55.0 55.0 55.0 55.0 55.0		40 30 20 10	55 55 55 55 55	.0 .0 .0		
PUMP AND PIPING	G SYSTEM	DATA					
Pump or Piping System		Delta-T (F)	Pump Head (ft wg)	Effici Mech (%)	Elec	Pump Power (kW)	Piping Gain/Loss (%)
Hot Water		59.4	20.00	85.0	90.0	1.49	2.0

Plant: 117-3 CA-602 A/C DX Cooling BL Prepared By: Keller & Gannon **********************************		******	12-20-94 Page 1 ******
Plant name	oled DX	Cooling BL	
AIR SYSTEM SELECTIONS			
	Туре		
7. AC-602, Work Corridor, 117-3 BL.			
AIR-COOLED DX COOLING DATA			
COOLING DATA Estimated maximum cooling load: Design OAT	NA		

Plant: 117-3 Stm-0 Prepared By: Kelle ********	Slycol AC-602 : er & Gannon			*****	12-20-94 Page 1 ******
PLANT NAME, CLASSI	FICATION & TY	PE			
Plant name Classification Type Notes Notes		Heating Hot Water Remote sou	Boiler rce is t	he Boiler P	lant 117-2 Rm @ 15psi
AIR SYSTEM SELECTI	ons				
Air System Na	me	Pre-H	eat Cen	Coil Catego tral Termin	nal Zone
7. AC-602, Work	Corridor, 117-	-3 BL		1 -	1
HOT WATER BOILER D	АТА				
Estimated maximum Gross output at a Energy input at a Overall efficient Fuel or energy to Combustion air bushed oil pump kw	designdesigncy at design ypeype	900 : 1637 : 5 : Fuel	3.0 MBH 5.0 %		
BOILER PART-LOAD	PERFORMANCE D	ATA			
% Load Overall	Eff. (%) %	Load Over	ill Eff.	(%)	
90 55 80 55 70 55 60 55 50 55	. 0 . 0 . 0	40 30 20 10 0	55.0 55.0 55.0 55.0 55.0		
PUMP AND PIPING SYS	STEM DATA				
Pump or Piping System		Head Me	iciencie ch Ele %) (%	c Power	Gain/Loss
			-, (-	, (22)	(%)

Plant: 117-3 CA-602 A/C DX Cooling R1 Prepared By: Keller & Gannon **********************************		****	12-20-94 Page 1 ******
PLANT NAME, CLASSIFICATION & TYPE			
Plant name: 117-3 (Classification: Cooling Type: Air-Cooling Type of simulation model: Compute	T C	Cooling R1	
AIR SYSTEM SELECTIONS			
Air System Name	Type	Quantity	
17. AC-602, Work Corridor, 117-3 R1.	. (SZ CAV)	1	
AIR-COOLED DX COOLING DATA			
COOLING DATA Estimated maximum cooling load: Design OAT	NA 97.0 F 10.0 Tons 13.0 kW 0.3 kW 0.000 kW 0.150 55.0 F		

	Stm-Glyc Keller &	ol AC-60	2 R1	IPUT DATA			12-20-9
******	******	****	*****	*****	*****	*****	Page :
PLANT NAME,	CLASSIFIC	ATION &	TYPE				
Plant name. Classificat Type Notes			.: Heatl .: Hot W	ng ater Boi e source	ler	vilom Dl-	nt 117-2 m @ 15psi
AIR SYSTEM SE	LECTIONS						
Air Syst				Pre-Heat	ting Coil Central	Termina	l Zone
17. AC-602,	Work Corr	idor, 11	.7-3 R1.		1		1
HOT WATER BOI Estimated m Gross outpu		ating lo	ad:	 NA			~
Energy inpu Overall eff Fuel or ener Combustion a Fuel oil pu	iciency a rgy type. air blowe	gn t design r kW	F	16378.0 55.0 Fuel Oil	MBH % vw		
BOILER PART	-LOAD PER	FORMANCE	DATA				
	rall Eff		 % T.oad	0			
% Load Over			o Dodd	overall			
% Load Over 90 80 70 60 50	55.0 55.0 55.0 55.0 55.0		40 30 20 10	55 55 55 55 55	. 0 . 0 . 0		
90 80 70 60 50	55.0 55.0 55.0 55.0 55.0		40 30 20 10	55 55 55 55	. 0 . 0 . 0		
90 80 70 60	55.0 55.0 55.0 55.0 55.0		40 30 20 10	55 55 55 55 55 Efficie	. 0 . 0 . 0 . 0	Pump	

Plant: 117-3 CA-602 A/C DX Cooling R2 Prepared By: Keller & Gannon **********************************		*****	12-20-94 Page 1 ******
Plant name	g oled DX	Cooling R2	
AIR SYSTEM SELECTIONS			
Air System Name	Type	Quantity	
28. AC-602, Work Corridor, 117-3 R2.	. (SZ CAV)	1	
AIR-COOLED DX COOLING DATA			
COOLING DATA Estimated maximum cooling load: Design OAT	NA 97.0 F 10.0 Tons 13.0 kW 0.3 kW 0.000 kW 0.150 55.0 F N		

Prepared By: Keller & Gannon	Plant: 117-3 Stm-Glyc		LANT INP	UT DATA			12-20-94
Plant name	Prepared By: Keller &	Gannon					Page 1
Plant name	******	*****	*****	****	*****	*****	*****
Classification	PLANT NAME, CLASSIFIC	ATION & I	YPE				
## Air System Name	Classification Type Notes		<pre>: Heatin : Hot Wa : Remote</pre>	g ter Boi source	ler is the Bo	iler Pla	nt 117-2 m @ 15psi
Air System Name	AIR SYSTEM SELECTIONS						
### HOT WATER BOILER DATA Estimated maximum heating load: NA Gross output at design: 9007.9 MBH Energy input at design: 16378.0 MBH Overall efficiency at design: 55.0 % Fuel or energy type: Fuel Oil Combustion air blower kW: 0.200 kW Fuel oil pump kW: 0.050 kW BOILER PART-LOAD PERFORMANCE DATA % Load Overall Eff. (%) % Load Overall Eff. (%) % Load Overall Eff. (%) % Load Overall Eff. (%) % Load Overall Eff. (%) % Load Overall Eff. (%) % Load Overall Eff. (%) % Load Overall Eff. (%) % Load Overall Eff. (%) % % % % % % % % %	Air System Name		P	Heat	ating Coil Central	Category Termina	y l Zone
Estimated maximum heating load: NA Gross output at design: 9007.9 MBH Energy input at design: 16378.0 MBH Overall efficiency at design: 55.0 % Fuel or energy type: Fuel Oil Combustion air blower kW: 0.200 kW Fuel oil pump kW: 0.050 kW BOILER PART-LOAD PERFORMANCE DATA ** Load Overall Eff. (*)	28. AC-602, Work Cor	ridor, 11	7-3 R2	-	1	_	1
Estimated maximum heating load: NA Gross output at design: 9007.9 MBH Energy input at design: 16378.0 MBH Overall efficiency at design: 55.0 % Fuel or energy type: Fuel Oil Combustion air blower kW: 0.200 kW Fuel oil pump kW: 0.500 kW BOILER PART-LOAD PERFORMANCE DATA * Load Overall Eff. (%) % Load Overall Eff. (%) 90	HOT WATER BOILER DATA						
* Load Overall Eff. (%)	Gross output at des Energy input at des Overall efficiency Fuel or energy type Combustion air blow	ign ign at design er kW	F1	9007.9 16378.0 55.0 uel Oil 0.200	MBH MBH %		
90 55.0 40 55.0 80 55.0 30 55.0 70 55.0 20 55.0 60 55.0 10 55.0 50 55.0 0 55.0 PUMP AND PIPING SYSTEM DATA Pump Efficiencies Pump Piping Pump or Pump Piping Pump or Head Mech Elec Power Gain/Loss Piping System (F) (ft wg) (%) (%) (%) (%)	BOILER PART-LOAD PE	RFORMANCE	DATA				
90 55.0 40 55.0 80 55.0 30 55.0 70 55.0 20 55.0 60 55.0 10 55.0 50 55.0 0 55.0 PUMP AND PIPING SYSTEM DATA Pump Efficiencies Pump Piping Pump or Delta-T Head Mech Elec Power Gain/Loss Piping System (F) (ft wg) (%) (%) (%) (%)	% Load Overall Eff	. (%)	% Load (Overall	Eff. (%)		
Pump Efficiencies Pump Piping Pump or Delta-T Head Mech Elec Power Gain/Loss Piping System (F) (ft wg) (%) (%) (kW) (%)	80 55.0 70 55.0 60 55.0		30 20 10	55 55 55	. 0 . 0 . 0		
Pump or Delta-T Head Mech Elec Power Gain/Loss Piping System (F) (ft wg) (%) (%) (kW) (%)	PUMP AND PIPING SYSTEM	M DATA					
Hot Water 17.7 20.00 85.0 90.0 5.00 2.0			Head	Mech	Elec	Power	Gain/Loss
	Hot Water	17.7	20.00	85.0	90.0	5.00	2.0

Plant: 117-3 CA-602 A/C DX Coolng R2B Prepared By: Keller & Gannon **********************************		*****	12-20-94 Page 1 ******
PLANT NAME, CLASSIFICATION & TYPE			
Plant name	g oled DX	Coolng R2B	
AIR SYSTEM SELECTIONS			
Air System Name	Туре		
29. AC-602, Work Corridor, 117-3 R2	B. (SZ CAV)	1	
AIR-COOLED DX COOLING DATA			
Design OATGross cooling capacity	40.4 Tons 97.0 F 10.0 Tons 13.0 kW 0.3 kW 0.000 kW 0.150 55.0 F		

Plant name	Dropared B	-3 Stm-Glyco y: Keller & *******	1 AC-602				*****	12-20-94 Page 1 ******
Classification	PLANT NAME	, CLASSIFICA	TION & T	YPE				
Heating Coil Category Pre-Heat Central Terminal Zone	Classific Type Notes	cation		: Heatin: Hot Wa: Remote	g ter Boi source	ler is the Bo	oiler Pla	
Air System Name	AIR SYSTEM	SELECTIONS						
## HOT WATER BOILER DATA Estimated maximum heating load: 647.2 MBH Gross output at design: 9007.9 MBH Energy input at design: 16378.0 MBH Overall efficiency at design: 55.0 % Fuel or energy type: Fuel Oil Combustion air blower kW: 0.200 kW Fuel oil pump kW: 0.050 kW ### BOILER PART-LOAD PERFORMANCE DATA ### Load Overall Eff. (%) % Load Overall Eff. (%) 90	Air Sy	stem Name		P:	Heat	ating Coil Central	Categor Termina	y 1 Zone
Estimated maximum heating load: 647.2 MBH Gross output at design	29. AC-602	, Work Corr	idor, 11	7-3 R2B.	-	1	-	1
Gross output at design: 9007.9 MBH Energy input at design: 16378.0 MBH Overall efficiency at design: 55.0 % Fuel or energy type	HOT WATER E	BOILER DATA						
* Load Overall Eff. (%)	Gross out Energy ir Overall e Fuel or e Combustic	put at desi put at desi efficiency a energy type. on air blowe	gn gn t design r kW	F1	9007.9 16378.0 55.0 uel Oil 0.200	MBH MBH %		
* Load Overall Eff. (%)	BOILER PA	RT-LOAD PER	FORMANCE	DATA				
90 55.0 40 55.0 80 55.0 30 55.0 70 55.0 20 55.0 60 55.0 10 55.0 50 55.0 0 55.0 PUMP AND PIPING SYSTEM DATA Pump Efficiencies Pump Piping Pump or Head Mech Elec Power Gain/Loss Piping System (F) (ft wg) (%) (%) (%) (%)	% Load C	verall Eff.	(%)	% Load (Overall	Eff. (%)		
Pump Efficiencies Pump Piping Pump or Delta-T Head Mech Elec Power Gain/Loss Piping System (F) (ft wg) (%) (%) (kW) (%)	80 70 60	55.0 55.0 55.0		30 20 10	55 55 55	5.0 5.0		
Pump or Delta-T Head Mech Elec Power Gain/Loss Piping System (F) (ft wg) (%) (%) (kW) (%)	PUMP AND PI	PING SYSTEM	DATA					
Hot Water 17.7 20.00 85.0 90.0 5.00 2.0		em		Head	Mech	Elec	Power	Gain/Loss
	Hot Water		17.7	20.00	85.0	90.0	5.00	2.0

Plant: 117-3 Stm-Glyc Prepared By: Keller & *******	ol HV-601 Gannon	BL	PUT DATA		*****	12-20-94 Page 1 *****
PLANT NAME, CLASSIFIC	ATION & T	YPE				
Plant name Classification Type Notes		: Heati : Hot W : Remot	ng Water Boi e source	ler is the Bo	oiler Pla	nt 117-2 m @ 15psi
AIR SYSTEM SELECTIONS						
Air System Name			He Pre-Heat	ating Coil Central	l Categor Termina	y 1 Zone
8. HV-601 Mech Rm H	kV Unit 1	17-3 BL	. -	1	-	1
Estimated maximum he Gross output at dest Energy input at dest Overall efficiency a Fuel or energy type. Combustion air blowe Fuel oil pump kW	gn gn at design er kW		9007.9 16378.0 55.0	MBH MBH %		
BOILER PART-LOAD PER						
% Load Overall Eff. 90 55.0 80 55.0 70 55.0 60 55.0 50 55.0	(%)	40 30 20 10	5! 5! 5!	5.0 5.0		
PUMP AND PIPING SYSTEM	DATA					
Pump or Piping System	Delta-T (F)				Pump Power (kW)	Piping Gain/Loss (%)
Hot Water	18.6	20.0	0 85.0	90.0	4.77	2.0

*******	y: Keller &	l HV-601 Gannon ******		*****	*****	*****	12-20-9 Page ******
PLANT NAME	, CLASSIFICA	TION & TY	PE				
Classifi Type Notes	mecation	• • • • • • • • • • • • • • • • • • • •	Heatin Hot Wa Remote	ig iter Boi : source	ler is the B	oiler Pla	ant 117-2 Rm 0 15psi
AIR SYSTEM	SELECTIONS						
Air S	ystem Name		P:		ating Coi Central		
18. HV-60	1 Mech Rm H&	V Unit 11	7-3 R1.	-	1	-	1
HOT WATER	BOILER DATA						
Gross out Energy in Overall e Fuel or e Combustic	d maximum heatput at designput at designput at designergy type. on air blower pump kw	gngnt design.	F	16378.0 55.0 uel Oil	MBH % kW		
BOILER PA	ART-LOAD PERI	FORMANCE I	DATA				
	ART-LOAD PERI) Overall	Eff. (%)		
				 55	.0		
% Load 0 90 80 70 60 50	55.0 55.0 55.0 55.0 55.0	(%) %	40 30 20 10	55 55 55 55 55	.0		
% Load 0 90 80 70 60 50	55.0 55.0 55.0 55.0 55.0 55.0	(%) % DATA Delta-T	Load () 30 20 10 0	55 55 55 55 55 55 Effici Mech	.0		

PLANT INP Plant: 117-5 Work Room A/C DX Unit BL Prepared By: Keller & Gannon **********************************		*****	12-20-94 Page 1 ******
PLANT NAME, CLASSIFICATION & TYPE			
Plant name	g oled DX er-Generated		
AIR SYSTEM SELECTIONS			
Air System Name		Quantity	
10. AC-1001 Work Room 117-5 BASELIN	E. (SZ CAV)	1	
AIR-COOLED DX COOLING DATA			
COOLING DATA Estimated maximum cooling load:	NA 97.0 F 35.0 Tons 56.3 kW 5.0 kW 0.000 kW 0.150 55.0 F N		

Plant: 117-5 Work Rm A/C DX Unit R1 Prepared By: Keller & Gannon **********************************		*****	12-20-94 Page 1 ******
PLANT NAME, CLASSIFICATION & TYPE			
Plant name	ng poled DX	Unit R1	
AIR SYSTEM SELECTIONS			
Air System Name	Туре		
20. AC-1001 Work Room 117-5 R1	(SZ CAV)	1	
AIR-COOLED DX COOLING DATA			
COOLING DATA Estimated maximum cooling load: Design OAT	35.0 Tons 56.3 kW 5.0 kW 0.000 kW		

Plant: 117-5 Work Rm A/C-DX Unit R2 Prepared By: Keller & Gannon **********************************		*****	12-20-94 Page 1 *******
Plant name	led DX		
AIR SYSTEM SELECTIONS			
Air System Name	Туре	Quantity	
27. AC-1001 Work Room 117-5 R2	. (SZ CAV)	1	
AIR-COOLED DX COOLING DATA			
Design OATGross cooling capacity	33.0 Tons 97.0 F 35.0 Tons 56.3 kW 5.0 kW 0.000 kW 0.150 55.0 F		

Plant: 117-5 Work Room A/C-DX Unit R3 Prepared By: Keller & Gannon **********************************		*****	12-20-94 Page 1 ******
PLANT NAME, CLASSIFICATION & TYPE			
Plant name) oled DX		
AIR SYSTEM SELECTIONS			
Air System Name			
21. AC-1001 Work Room 117-5 R3			
AIR-COOLED DX COOLING DATA			
Outdoor fan power at design Crankcase heater kW	97.0 F		

Prepared By: Keller & Gannon Page ************************************	1
	*
PLANT NAME, CLASSIFICATION & TYPE	
Plant name: 117-5 Stm-Glycol AC-1001 BL Classification: Heating Type: Hot Water Boiler Notes: Remote source is the Boiler Plant 117-2 Notes: Steam supplied to HtEX in Blr Rm @ 15psi	
AIR SYSTEM SELECTIONS	
Heating Coil Category Air System Name Pre-Heat Central Terminal Zone	
10. AC-1001 Work Room 117-5 BASELINE 1	_
HOT WATER BOILER DATA	_
Estimated maximum heating load: 939.5 MBH Gross output at design: 9007.9 MBH Energy input at design: 16378.0 MBH Overall efficiency at design: 55.0 % Fuel or energy type Fuel Oil Combustion air blower kW 0.200 kW Fuel oil pump kW 0.050 kW	
BOILER PART-LOAD PERFORMANCE DATA	_
<pre>% Load Overall Eff. (%) % Load Overall Eff. (%)</pre>	_
90 55.0 80 55.0 70 55.0 60 55.0 50 55.0 50 55.0	_
PUMP AND PIPING SYSTEM DATA	_
Pump Efficiencies Pump Piping Pump or Delta-T Head Mech Elec Power Gain/Loss Piping System (F) (ft wg) (%) (%) (kW) (%)	s
Hot Water 139.9 40.00 85.0 90.0 1.27 2.0	0

Plant: 117-5 Stm-Glyc	ol AC-100	PLANT INI D1 R1	PUT DATA			12-20-94
Prepared By: Keller & **********	*******	*****	*****	*****	*****	Page 1
PLANT NAME, CLASSIFIC	r & noita	TYPE				
Plant name Classification Type Notes	••••••	: Heatir : Hot Wa : Remote : Steam	ng ater Boi source	ler is the Bo	iler Pla	nt 117-2 m @ 15psi
AIR SYSTEM SELECTIONS						
Air System Name		F	re-Heat	ating Coil Central	Termina	l Zone
20. AC-1001 Work Room	m 117-5 R	1	. -	1	_	-
HOT WATER BOILER DATA						
Estimated maximum he Gross output at desi Energy input at desi Overall efficiency a Fuel or energy type. Combustion air blower Fuel oil pump kw	at design	F	55.0 uel Oil	*		
BOILER PART-LOAD PER	RFORMANCE	DATA				
% Load Overall Eff.	(%)	% Load	Overall	Eff. (%)		
90 55.0 80 55.0 70 55.0 60 55.0 50 55.0		40 30 20 10 0	55 55	5.0 5.0		
PUMP AND PIPING SYSTEM	I DATA					
Pump or	Delta-T	Pump Head		encies Elec	Pump Power	Piping Gain/Loss
Piping System	(F)	(ft wg)		(%)	(kW)	(%)

Plant: 117-5 Stm/Glyco Prepared By: Keller & ********	1 AC-1001 R2	NPUT DATA	*****	*****	12-20-94 Page 1 ******
PLANT NAME, CLASSIFICA	ATION & TYPE				
Plant name	Heat	ing Water Boil ote source	er is the Bo	iler Plan	
AIR SYSTEM SELECTIONS					
Air System Name		Pre-Heat	ting Coil Central	Terminal	Zone
27. AC-1001 Work Room	117-5 R2				
HOT WATER BOILER DATA					
Estimated maximum he Gross output at desi Energy input at desi Overall efficiency a Fuel or energy type. Combustion air blowe Fuel oil pump kw	gngngnt designr	9007.9 1 16378.0 1 55.0 Fuel Oil 0.200 1	MBH MBH % kW		
BOILER PART-LOAD PER	FORMANCE DATA				
% Load Overall Eff.	(%) % Load	Overall	Eff. (%)		
90 55.0 80 55.0 70 55.0 60 55.0 50 55.0	30 20 10	55 55 55 55 55	.0 .0 .0		
PUMP AND PIPING SYSTEM	DATA				
Pump or Piping System	Pu Delta-T He (F) (ft w	ad Mech		Pump Power ((kW)	Piping Gain/Loss (%)
Hot Water	139.9 40.	00 85.0	90.0	1.27	2.0

Plant: 117-5 Stm / Gl Prepared By: Keller & ************	ycol AC-1	001 R3	PUT DATA	-	:****	12-20-94 Page 1
PLANT NAME, CLASSIFICA	ATION & T	YPE				
Plant name	• • • • • • • • •	HeatingHot WaterRemote	ng ater Boi e source	ler is the	Boiler Dl	ant 117-2 Rm @ 15psi
AIR SYSTEM SELECTIONS						
Air System Name			He Pre-Heat	ating Co Centra	il Catego l Termin	al Zone
21. AC-1001 Work Room	117-5 R	3	_	1		_
HOT WATER BOILER DATA						
Estimated maximum he Gross output at desi Energy input at desi Overall efficiency a Fuel or energy type. Combustion air blowe Fuel oil pump kW	t design.	: F	55.0 uel Oil	*		
BOILER PART-LOAD PER	FORMANCE	DATA				
% Load Overall Eff.	(%) %	Load	Overall	Eff. (%)		
90 55.0 80 55.0 70 55.0 60 55.0 50 55.0		40 30 20 10 0	55 55 55 55	5.0 5.0		
PUMP AND PIPING SYSTEM	DATA					
Pump or Piping System	Delta-T (F)		Mech		Pump Power (kW)	Piping Gain/Loss (%)
					• •	\ · /

Plant: 117-5 Stm-Glyco Prepared By: Keller &	ol AC-1002 Gannon	BL	PUT DATA	*****	*****	12-20-94 Page 1 ******
PLANT NAME, CLASSIFICA	ATION & TY	PE				
Plant name Classification Type Notes		Heatin Hot Wa Remote	ng ater Boil e source	ler is the Bo	oiler Pla	
AIR SYSTEM SELECTIONS						
Air System Name			Hea Pre-Heat	ting Coil Central	. Category Termina	y L Zone
11. AC-1002 Mech Rm 8	WCs 117-	BL	. <u>-</u>	1	_	1
HOT WATER BOILER DATA						
Estimated maximum he Gross output at desi Energy input at desi Overall efficiency a Fuel or energy type. Combustion air blowe Fuel oil pump kw	gn gn t design r kW	· · · · · · · · · · · · · · · · · · ·	9007.9 16378.0 55.0 Fuel Oil	MBH % kW		
BOILER PART-LOAD PER	FORMANCE I	ATA				
<pre>% Load Overall Eff.</pre>	(%) %	Load	Overall	Eff. (%)		
90 55.0 80 55.0 70 55.0 60 55.0 50 55.0		40 30 20 10 0		.0		
PUMP AND PIPING SYSTEM	DATA					
Pump or Piping System	Delta-T (F) (Pump Head ft wg)	Mech	encies Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Hot Water	443.5	40.00	85.0	90.0	0.40	2.0

Plant: 117-5 S Prepared By: K *******	aller £	ol AC-100	2 R1	*****	_	*****	12-20-94 Page 1 ******
PLANT NAME, CL	ASSIFICA	ATION & T	YPE				
Plant name Classification Type Notes	on		: Heati : Hot W : Remot	ng ater Boi e source	ler is the	Boiler Pl	ant 117-2 Rm @ 15psi
AIR SYSTEM SELI	ECTIONS						
Air Syster	n Name]			il Catego: l Termin	
22. AC-1002 Me	ch & Wo	117-5 R	1 & R2.	<u> </u>	1	-	1
HOT WATER BOILE	R DATA						
Estimated max Gross output Energy input Overall effic Fuel or energ Combustion ai Fuel oil pump	at desi at desi iency a y type. r blowe	gn gn t design r kW		9007.9 16378.0 55.0 Tuel Oil	MBH MBH %		
BOILER PART-L	OAD PER	FORMANCE	DATA				
% Load Overa	ll Eff.	(%)	Load	Overall	Eff. (%)	
90 80 70 60 50	55.0 55.0 55.0 55.0		40 30 20 10 0	55 55 55			
PUMP AND PIPING	SYSTEM	DATA					
Pump or Piping System	 -	Delta-T (F)	Pump Head (ft wg)	Mech	encies Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Hot Water		443.5	40.00	85.0	90.0	0.40	2.0

	PL	ANT INF	OT DATA			
Plant: 117-5 Stm-Glycon Prepared By: Keller &	Gannon					12-20-94 Page 1
******	*****	*****	*****	*******	*****	*****
PLANT NAME, CLASSIFICA	ATION & TY	PE				
Plant name Classification Type Notes Notes	· • • • • • • • • • • • • • • • • • • •	Heatin Hot Wa Remote	g ter Boil source	ler is the Bo	oiler Pla	
AIR SYSTEM SELECTIONS						
Air System Name			re-Heat		Termina	l Zone
22. AC-1002 Mech & WC	117-5 R1	& R2	-	1	_	1
HOT WATER BOILER DATA						
Estimated maximum he Gross output at desi Energy input at desi Overall efficiency a Fuel or energy type. Combustion air blower Fuel oil pump kw	t design.	F	55.0 uel Oil	*		
BOILER PART-LOAD PER	FORMANCE	DATA				
% Load Overall Eff.	(%) %	Load	Overall	Eff. (%)		
90 55.0 80 55.0 70 55.0 60 55.0 50 55.0		40 30 20 10 0		. 0 . 0 . 0		
PUMP AND PIPING SYSTEM	DATA					
Pump or Piping System	Delta-T (F)	Pump Head (ft wg)	Mech		Pump Power (kW)	Piping Gain/Loss (%)
Hot Water	443.5	40.00	85.0	90.0	0.40	2.0

Plant: 117-5 Stm-Glyco Prepared By: Keller & *********	ol AC-100				*****	12-20-94 Page 1 ******
PLANT NAME, CLASSIFICA	TION & T	YPE				
Plant name	• • • • • • • • • • • • • • • • • • • •	: Heating : Hot War : Remote	ng ater Boi e source	ler is the B	oiler Pla	nt 117-2 m @ 15psi
AIR SYSTEM SELECTIONS						
Air System Name		F	He Pre-Heat	ating Coi Central	l Categor Termina	У
23. AC-1002 Mech & WC		3	. -	1		1
HOT WATER BOILER DATA						
Estimated maximum he Gross output at desi Energy input at desi Overall efficiency a Fuel or energy type. Combustion air blower Fuel oil pump kW	gn gn t design r kW	: : F	9007.9 16378.0 55.0 uel Oil 0.200	MBH MBH %		
BOILER PART-LOAD PER	FORMANCE	DATA				
<pre>% Load Overall Eff.</pre>	(%)	% Load	Overall	Eff. (%)		
90 55.0 80 55.0 70 55.0 60 55.0 50 55.0		40 30 20 10 0	55 55 55	5.0		
PUMP AND PIPING SYSTEM	DATA					
Pump or Piping System		Pump Head (ft wg)	Mech	encies Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Hot Water	443.5	40.00	85.0	90.0	0.40	2.0

Plant: 117-5 Stm-Glyco Prepared By: Keller & ********	l UH-1001 BL Gannon	NPUT DATA	*****	****	12-20-94 Page 1
PLANT NAME, CLASSIFICA	TION & TYPE				
Plant name	Heat ! Hot ! Remo!	ing Nater Boil te source	ler is the Bo	iler Pla	nt 117-2 n @ 1 5psi
AIR SYSTEM SELECTIONS					
Air System Name		Неа	ating Coil Central	Terminal	Zone
13. UH-1001. 2 Htrs,1					_
Estimated maximum her Gross output at design Energy input at design Overall efficiency at Fuel or energy type. Combustion air blower Fuel oil pump kw	t design: r kw	55.0 Fuel Oil 0.200	MBH MBH MBH %		
BOILER PART-LOAD PERI	FORMANCE DATA				
<pre>% Load Overall Eff.</pre>	(%) % Load	Overall	Eff. (%)		
90 55.0 80 55.0 70 55.0 60 55.0 50 55.0	40 30 20 10 0	55 55 55 55	.0		
PUMP AND PIPING SYSTEM	DATA				
Pump or Piping System	Pum Delta-T Hea (F) (ft wg	d Mech	Elec	Pump Power (kW)	Piping Gain/Loss (%)
Hot Water	%1478.2 40	.00 85.	0 90.0	0.12	2.

Plant: 117-5 Stm-Glyco Prepared By: Keller &	PLANT INPUT DATA 1 UH-1001 R1 Gannon **********************************	12-20-94 Page 1
PLANT NAME, CLASSIFICA		****
Classification Type Notes	: 117-5 Stm-Glycol UH-1001 R1: Heating: Hot Water Boiler: Remote source is the Boiler Plant: Steam supplied to HtEX in Blr Rm	
AIR SYSTEM SELECTIONS		
Air System Name	Heating Coil Category Pre-Heat Central Terminal	
26. UH-1001 Htrs,117-	5 Mech BL R12&3 1 -	-
HOT WATER BOILER DATA		
Gross output at design Energy input at design Overall efficiency a Fuel or energy type.	gn: 16378.0 MBH c design: 55.0 % : Fuel Oil c kW: 0.200 kW	
BOILER PART-LOAD PER	FORMANCE DATA	
% Load Overall Eff.	(%) % Load Overall Eff. (%)	
90 55.0 80 55.0 70 55.0 60 55.0 50 55.0	40 55.0 30 55.0 20 55.0 10 55.0 0 55.0	
PUMP AND PIPING SYSTEM	DATA	
Pump or Piping System	Pump Efficiencies Pump Delta-T Head Mech Elec Power G (F) (ft wg) (%) (%) (kW)	Piping ain/Loss (%)
Hot Water	%1478.2 40.00 85.0 90.0 0.12	2.0

Prepared By: Keller & ***********	ol HV-1001 R2 Gannon *********	*****	*****	12-20-94 Page 1
PLANT NAME, CLASSIFICA				
Plant name	Heating Remote s	er Boiler source is the Bo upplied to HtEX	oiler Plant	117-2 @ 15psi
AIR SYSTEM SELECTIONS				
Air System Name	Pre	Heating Coil	Category Terminal	Zone
26. UH-1001 Htrs,117-	-5 Mech BL R12&3.	- 1	-	-
Estimated maximum he Gross output at desi Energy input at desi Overall efficiency a Fuel or energy type. Combustion air blower Fuel oil pump kw	gn	9007.9 MBH 5378.0 MBH 55.0 %		
BOILER PART-LOAD PER	FORMANCE DATA			
BOILER PART-LOAD PER	(%) % Load Ov			
BOILER PART-LOAD PER % Load Overall Eff. 90 55.0 80 55.0 70 55.0 60 55.0 50 55.0	(%) % Load Ov 40 30 20 10 0	verall Eff. (%) 55.0 55.0 55.0 55.0		
BOILER PART-LOAD PER * Load Overall Eff. 90 55.0 80 55.0 70 55.0 60 55.0	(%) % Load Ov 40 30 20 10 0	7erall Eff. (%) 55.0 55.0 55.0 55.0 55.0	Pump	Piping ain/Loss (%)

Plant: 117-5 Strepared By: Ko	eller & Can	V-1001 R3	PUT DATA			12-20-94 Page 1
*******	*****	**********	*****	******	******	******
PLANT NAME, CL	ASSIFICATIO	N & TYPE				
Plant name Classification Type Notes Notes	on	: Heatir : Hot Wa : Remote	ng ater Boile e source i	er Is the Bo	iler Pla	nt 117-2 m @ 15psi
AIR SYSTEM SELE	ECTIONS					
Air System	n Name	I	Pre-Heat	Central	Category Terminal	l Zone
26. UH-1001 Ht				1	-	-
HOT WATER BOILE						
Estimated max Gross output Energy input Overall effic Fuel or energ Combustion ai Fuel oil pump	ciency at de	esign: F	55.0 % uel Oil			
BOILER PART-L	OAD PERFORM	ANCE DATA				
% Load Overa	ll Eff. (%)	% Load	Overall E			
90 80 70 60 50	55.0 55.0 55.0 55.0 55.0	40 30 20 10 0	55.0 55.0 55.0 55.0	0 0 0 0		
PUMP AND PIPING	SYSTEM DAT	 А				
Pump or Piping System		Pump ta-T Head (F) (ft Wg)		Elec	Pump Power (kW)	Piping Gain/Loss (%)
		~~				

Plant: 117-5 Non Egy Use DX Unit BL Prepared By: Keller & Gannon **********************************		*****	12-20-94 Page 1 *******
Plant name	g oled DX		
AIR SYSTEM SELECTIONS			
Air System Name	Type	Quantity	
11. AC-1002 Mech Rm & WCs 117-5 BL.			
AIR-COOLED DX COOLING DATA			
COOLING DATA Estimated maximum cooling load: Design OAT	NA		

Plant: 117-5 Non Egy Use DX Unit R1 Prepared By: Keller & Gannon **********************************		*****	12-20-94 Page 1 ******
PLANT NAME, CLASSIFICATION & TYPE Plant name: 117-5 Classification: Coolin Type	ng poled DX		
AIR SYSTEM SELECTIONS			
Air System Name	Туре	Quantity	
22. AC-1002 Mech & WC 117-5 R1 & R2			
AIR-COOLED DX COOLING DATA			
COOLING DATA Estimated maximum cooling load: Design OAT	NA 97.0 F 0.0 Tons 0.0 kW 0.0 kW 0.000 kW 0.000 55.0 F N		

PLANT INPUT Plant: 117-5 Non Egy Use DX Unit R2 Prepared By: Keller & Gannon **********************************	-		20-94 ge 1 ****
Plant name	led DX	OX Unit R2	
AIR SYSTEM SELECTIONS			
Air System Name	Туре	Quantity	
19. Infilt Drs Open-Wk Rm 117-5 R2&3. 22. AC-1002 Mech & WC 117-5 R1 & R2 24. WINTER AC-1002 Mch&WC 117-5 R1&2. 26. UH-1001 Htrs,117-5 Mech BL R12&3.	(MZ) (MZ)	1 1	
AIR-COOLED DX COOLING DATA			
Gross cooling capacity	NA 97.0 F 0.0 Tons 0.0 kW 0.00 kW 0.000 kW 0.000 55.0 F N		

Plant: 117-5 Non Egy Use DX Unit R3 Prepared By: Keller & Gannon **********************************	******	******	12-20-94 Page 1 ******
Plant name	ng ooled DX		
AIR SYSTEM SELECTIONS			
Air System Name	 Туре	Quantity	
23. AC-1002 Mech & WC 117-5 R3	··· (M4)	1	
AIR-COOLED DX COOLING DATA	•		
COOLING DATA	0.0 Tons 0.0 kW 0.0 kW 0.000 kW 0.000		

BUILDING INF Prepared by: Keller & Gannon HAP v3.06 ************************************	12-20-94 Page 1 ***********
PLANT SELECTION	
Plant Name	Type Quantity
2. Srvcs&Surt ACTUAL Cooler BL (A 4. Elec Supply HC-702, 117-1 BL (E 13. Srvcs & Spprt Bdg Heating BL (H	LEC HTG) 1
MISCELLANEOUS ELECTRIC POWER USE	
Max. Pow Reference Name	er Use (kW) Schedule Name
Empty Empty Empty	0.0 NA 0.0 NA 0.0 NA 0.0 NA
MISCELLANEOUS FUEL USE Reference Fuel Fuel Conversion Name Type Units kBTU/Units	
Empty NG THM 100.0000 Empty NG THM 100.0000 Empty NG THM 100.0000 Empty NG THM 100.0000	0.0 NA 0.0 NA
Fuel Types: NG=Nat.Gas FO=Fuel Oil PR	=Propane RH=Rmt Htg
ELECTRIC RATE Electric rate Sierra Average building power factor.: NA	Pacific Power Company
FUEL RATES	
Natural gas	cne - LS No. 2 Fuel Oil

Prepared by: Keller & Gannon HAP v3.06 ************************************	12-20-94 Page 2 ********
Additional building floor area	0.0 sqft 100.00 %

Prepared by:	Keller & Ganno	BUILDING INPUT DAT on	'A 12-20-94
HAP v3.06	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1		Page 1 ***********
		vcs&Supprt ACTUAL	
PLANT SELECT			
Plant Na	ame	Тур	e Quantity
11. Srvcs&Su	irt ACTUAL Cool	7-1 BL (ELEC HT er R1 (A/C DX ing R1 (HW BOIL	CLG) 1
	S ELECTRIC POWE	R USE	
	ne	Max. Power Use (kW)	:
Empty Empty Empty		0.0 0.0 0.0 0.0	NA NA
MISCELLANEOUS 	Fuel Fuel	Conversion Max. kBTU/Units Use	Schedule Name
Empty Empty Empty Empty	NG THM NG THM NG THM NG THM	100.0000 0.0 100.0000 0.0 100.0000 0.0 100.0000 0.0	NA NA NA
Fuel Types: N	IG=Nat.Gas FO=	Fuel Oil PR=Propa	ne RH=Rmt Htg
ELECTRIC RATE			
Electric rat		: Sierra Pacif tor.: NA	ic Power Company
FUEL RATES			
Fuel oil Propane Remote source	te heating	: None: Hawthorne: None: None	

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******************	********
MISCELLANEOUS DATA	
Additional building floor area	
Source electric generating efficiency 100.00	8 -

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**************************************	*****
DY LVID GRY ROMEON	
PLANT SELECTION	
Plant Name Type Quantity	
5. 117-3 CA-601 A/C DX Cooling BL. (A/C DX CLG) 1 6. 117-3 Stm-Glycol AC-601 BL (HW BOILER) 1	
MISCELLANEOUS ELECTRIC POWER USE	
Max. Power Use	,
Reference Name (kW) Schedule Name	
Empty 0.0 NA	
Empty 0.0 NA Empty 0.0 NA	
Empty 0.0 NA	
MISCELLANEOUS FUEL USE	
Reference Fuel Fuel Conversion Max. Name Type Units kBTU/Units Use Schedule Name	
Empty NG THM 100.0000 0.0 NA	
Empty NG THM 100.0000 0.0 NA Empty NG THM 100.0000 0.0 NA	
Empty NG THM 100.0000 0.0 NA	
Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg	
ELECTRIC RATE	
Electric rate Sierra Pacific Power Company Average building power factor.: NA	
FUEL RATES	
Natural gas	
MISCELLANEOUS DATA	
Additional building floor area	t

BUILDING INPUT DATA	
Prepared by: Keller & Gannon HAP v3.06	12-20-9 Page
**************************************	******
PLANT SELECTION	
Plant Name Type Quantit	У
14. 117-3 CA-601 A/C DX Cooling R1. (A/C DX CLG) 1 15. 117-3 Stm-Glycol AC-601 R1 (HW BOILER) 1	
MISCELLANEOUS ELECTRIC POWER USE	
Max. Power Use	
(M) Donedate II	ame
Empty 0.0 NA Empty 0.0 NA	
Empty 0.0 NA	
Empty 0.0 NA	
MISCELLANEOUS FUEL USE	
Reference Fuel Fuel Conversion Max. Name Type Units kBTU/Units Use Schedule N	ame
Empty NG THM 100.0000 0.0 NA	
Empty NG THM 100.0000 0.0 NA Empty NG THM 100.0000 0.0 NA	
Empty NG THM 100.0000 0.0 NA	
Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt H	
ELECTRIC RATE	
Electric rate Sierra Pacific Power Comp Average building power factor.: NA	oany
FUEL RATES	
Natural gas: None Fuel oil	. Oil
MISCELLANEOUS DATA	
Additional building floor area	0.0 sqft 0.00 %

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**************************************				eas BI.		
PLANT SELECTI	ON					
Plant Na					ouantity	
7. 117-3 CA 26. 117-3 St	-602 A/	C DX Co	ooling BL. (A 2 BL (H	/C DX C W BOILE	LG) 1	
MISCELLANEOUS	ELECTR	IC POWE	R USE			
Reference Nam	e 		Max. Pow	(kW)	Schedule Name	
Empty Empty Empty				0.0 0.0 0.0	NA NA NA NA	
MISCELLANEOUS	FUEL U	SE				
Reference Name			Conversion kBTU/Units	Max. Use	Schedule Name	
Empty Empty Empty Empty		THM	100.0000 100.0000 100.0000 100.0000	0.0	NA NA NA NA	
Fuel Types: No	G=Nat.G				e RH=Rmt Htg	
ELECTRIC RATE						
Electric rate Average build	e ding po	wer fac	: Sierra tor.: NA	Pacifi	c Power Company	y
FUEL RATES						
Natural gas. Fuel oil Propane Remote source Remote source	······································	 ng	: None: Hawthor: None: None		S No. 2 Fuel O	
MISCELLANEOUS	DATA					
Additional by Source electi	uilding	floor erating	area		: 0	.0 sqft

			BUILDING INP	UT DATA	L	
Prepared by:	Keller	& Gann	on			12-20-94
HAP v3.06					*****	Page 1
BUILDING NAME						*****
DOIDDING NAME						
PLANT SELECTI	ON					
Plant Na	me			Туре	Quantity	
16 117-3 CA	-602 A	C DX C	ooling R1. (A	/C DX C	LG) 1	
28. 117-3 St	m-Glvc	1 AC-6	02 R1 (H	W BOILE	R) 1	
MISCELLANEOUS	ELECTE	RIC POWI	ER USE			
			Vers Des-			
Reference Nam	_		Max. Pow		Schedule Name	
reference Nam	e 			(kW)	Schedule Name	
Empty				0.0	NA	
Empty				0.0	NA	
Empty				0.0	NA	
Empty				0.0	NA	
MISCELLANEOUS	ו דינונים	CE				
MISCELLANEOUS						
Reference	Fuel	Fuel	Conversion	Max.		
Name					Schedule Name	
Empty	NG	THM	100.0000		NA	
Empty	NG	THM	100.0000	0.0	NA	
Empty Empty	NG NG	THM THM	100.0000 100.0000	0.0 0.0	NA NA	
Embcl			100.000			
Fuel Types: No	G=Nat.G	as FO=	Fuel Oil PR	=Propan	e RH=Rmt Htq	
ELECTRIC RATE						
Flootria rate				Pagifi	c Power Company	
Average build				Pacific	c rower company	
Average Darre						
FUEL RATES						
Natural gas	• • • • • •	• • • • • •	: None	T	S No. 2 Fuel Oil	
Propane				ne - L	s No. 2 ruei Oii	
Remote source						•
Remote source						

MISCELLANEOUS	DATA					
Additional bu	:1din~					sqft
Source electr	ic den	erating	efficiency		100.00	& S

Prepared by: HAP v3.06 ************************************	******	*****	*****	****** eas R2	******	
PLANT SELECTI	OM					
PLANT SELECTI	.ON					
Plant Na				Туре	Quantity	
38. 117-3 CA 39. 117-3 St	m-Glyco	C DX Co	ooling R2. (A D2 R2 (Hi	/C DX C	ELG) 1 ER) 1	
MISCELLANEOUS	ELECTR	RIC POWE	ER USE			
			Max. Pow	er Use		
Reference Nam					Schedule Name	
Empty				0.0	NA	
Empty				0.0	NA	
Empty				0.0 0.0	NA NA	
MISCELLANEOUS 			Conversion			
Name	Type		Conversion kBTU/Units		Schedule Name	
Empty	NG	THM	100.0000		NA	
Empty	NG				NA	
Empty	NG NG		100.0000 100.0000		NA NA	
Fuel Types: No	G=Nat.G	as F0=	Fuel Oil PR=	Propan	e RH=Rmt Htg	
ELECTRIC RATE						
Electric rate Average build		_		Pacifi	c Power Company	
FUEL RATES						
Natural gas. Fuel oil Propane Remote source Remote source	heating cooling	 ng	: Hawthor: None: None: None	ne - L	S No. 2 Fuel Oil	
MISCELLANEOUS	DATA					
Additional bu Source electr	cic gene	erating	efficiency		: 0.0 sqf : 100.00 %	

D				INPUT DAT	'A		
Prepared by: HAP v3.06	Keller	& Gann	on				12-20-94 Page 1
********						*****	rage 1
BUILDING NAM	1E		17-3. Wor	k Areas R2	В		
DIAMM CETECO	TON						
PLANT SELECT	TON	· 					
Plant N	lame			Тур	e Quar	ntity	
40. 117-3 C	A-602 A	C DX C	oolng R2B	. (A/C DX	CLG)	1	
41. 117-3 S	tm-Glyco	1 AC-60	02 R2B	. (HW BOIL	ER) 	1	
MTCCELLANGOL	e ereomr	TO DOM	D UCE	,			
MISCELLANEOU	S ELECTR	CIC POWI	EK USE				
Reference Na	mo		Max.	Power Use (kW)		o Namo	
				(NA)	Schedul	e Name	
Empty				0.0			
Empty				0.0			
Empty				0.0	NA		
							.======
MISCELLANEOU	S FUEL U	SE					
Reference	Fuel						
Name	Type	Units	kBTU/Uni	ts Use	Schedul	e Name	
Empty	NG NG	THM THM	100.00		NA		
Empty	NG NG	THM	100.00		NA NA		
Empty	NG	THM	100.00		NA		
Fuel Types: 1	NG=Nat.G	as FO=	Fuel Oil	PR=Propa	ne RH=Rm	t Htg	
ELECTRIC RATI	E						
Electric rat	te	 	Sie	rra Pacifi	c Power	Company	
Average buil	lding po	wer fac	tor.: NA			oopung	
				~			
FUEL RATES							
Natural gas.			: Non	e			
Fuel oil Propane	• • • • • • •	• • • • • •	: Haw	thorne - I	S No. 2 1	Fuel Oil	
Remote source							•
Remote source				е			
···							
MISCELLANEOUS	DATA				~~~~~		
Additional b		floor a	area		:	0.0 s	sqft
Source elect	ric gene	erating	erricieno		· · · · · · :	100.00 9	5

Plant Name Type Quantity	Page ********
BUILDING NAME: 117-3. Mechanical Room BL PLANT SELECTION Plant Name Type Quantity 27. 117-3 Stm-Glycol HV-601 BL (HW BOILER) MISCELLANEOUS ELECTRIC POWER USE	
Plant Name Type Quantity 27. 117-3 Stm-Glycol HV-601 BL (HW BOILER) 1 MISCELLANEOUS ELECTRIC POWER USE	
Plant Name Type Quantity 27. 117-3 Stm-Glycol HV-601 BL (HW BOILER) 1 MISCELLANEOUS ELECTRIC POWER USE	
27. 117-3 Stm-Glycol HV-601 BL (HW BOILER) 1 MISCELLANEOUS ELECTRIC POWER USE	
MISCELLANEOUS ELECTRIC POWER USE	
Max. Power Use	
Reference Name (kW) Schedule Name	
Empty 0.0 NA Empty 0.0 NA	
Empty 0.0 NA	
Empty 0.0 NA	
AISCELLANEOUS FUEL USE	
Reference Fuel Fuel Conversion Max.	
Name Type Units kBTU/Units Use Schedule Name	
Empty NG THM 100.0000 0.0 NA Empty NG THM 100.0000 0.0 NA	
Empty NG THM 100.0000 0.0 NA Empty NG THM 100.0000 0.0 NA	
Empty NG THM 100.0000 0.0 NA	
Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg	
ELECTRIC RATE	
Electric rate Sierra Pacific Power Company	
Average building power factor.: NA	
FUEL RATES	
Natural gas None Fuel oil Hawthorne - LS No. 2 Fuel Oil	
Propane None	
Remote source heating: None Remote source cooling: None	
IISCELLANEOUS DATA	
Additional building floor area 0.0 so	
Source electric generating efficiency: 100.00 %	

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BUILDING NAME					**************************************	*****
PLANT SELECTI	ON					
Plant Na	me			 Туре	Quantity	
29. 117-3 st	m-Glyco	1 HV-60)1 R1 (HV	V BOILE	ER) 1	
MISCELLANEOUS	ELECTE	RIC POWE				
Reference Nam	e		Max. Powe	r Use		
Empty Empty Empty Empty				0.0 0.0 0.0	NA NA NA NA	
MISCELLANEOUS	•					
Reference Name			Conversion kBTU/Units		Schedule Name	
Empty Empty Empty Empty Fuel Types: No	NG NG NG NG	THM THM THM	100.0000 100.0000 100.0000 100.0000	0.0 0.0 0.0	NA NA NA NA NA	
ELECTRIC RATE						
Electric rate Average build	ling po	wer fac	: Sierra tor.: NA	Pacifi	c Power Company	
FUEL RATES						
Natural gas Fuel oil Propane Remote source Remote source	heati	 	: Hawthor:: None: None: None	ne - L	S No. 2 Fuel Oil	
MISCELLANEOUS	DATA					
Additional bu Source electr						

			BUILDING INF	UT DAT	A	
Prepared by:	: Keller	& Gann	on			12-20-94
HAP v3.06		******	******	*****	*****	Page 1
			17-5. Work Ro			~~~~~~
DIAM CRIDO						
PLANT SELECT	T.TON					
Plant N	lame			Tvpe	Quantity	
8. 117-5 S	tm-Glyco	ol AC-1	001 BL (H	W BOIL	ER) 1	
9. 11/-5 W	OTK ROOM	n A/C D	K Unit BL. (A	/C DX C	CLG) 1	
MISCELLANEOU	S ELECTI	RIC POW	ER USE			
Reference Na	me		Max. Pow		Schedule Name	
vererence na					Schedate Name	
Empty				0.0	NA	
Empty				0.0	NA	
Empty				0.0	NA	
Empty				0.0	NA	
MISCELLANEOU	S FUEL U	ISE				
Reference	Fuel		Conversion		Cabadada Nama	
Name	туре	Units	kBTU/Units	Use	Schedule Name	
Empty	NG	THM	100.0000	0.0	NA	
Empty	NG		100.0000	0.0	NA	
Empty	NG	THM	100.0000	0.0	NA	
Empty	NG	THM	100.0000	0.0	NA	
Fuel Types: 1	NG=Nat.G	as FO=	Fuel Oil PR=	=Propan	e RH=Rmt Htg	
	_					
ELECTRIC RATI	E 					
Electric rat	te		: Sierra	Pacifi	c Power Company	
Average buil	lding po	wer fac	tor.: NA	140111	c rower company	
FUEL RATES						
FUEL RATES						
Natural gas.			: None			
				ne - L	S No. 2 Fuel Oil	
Propane					4	
Remote source						•
Remote source	e cool:	ng				
MISCELLANEOUS	DATA					
3 3 3 2 4 2 2 3						
			area efficiency			
POULCE ETECT	ric delle	== a c 1119	erriciency		100.00	3

Prepared by: K	eller	& Gann	BUILDING INP	UT DATA	A	12-20-94
HAP v3.06 ************ BUILDING NAME.					**************************************	Page 1 ******
PLANT SELECTION	N					
Plant Name	e 			Туре	Quantity	
17. 117-5 Stm 19. 117-5 Worl	-Glyco k Rm <i>P</i>	ol AC-10 A/C DX T	001 R1 (HV Jnit R1 (A	BOILE	ER) 1	
MISCELLANEOUS 1	ELECTE	RIC POWI	ER USE			
Reference Name			Max. Powe		Schedule Name	
Empty				0.0	NA	
Empty Empty				0.0	NA NA	
Empty				0.0	NA	
MISCELLANEOUS F	FUEL U	SE				
Reference Name	Fuel Type		Conversion kBTU/Units		Schedule Name	
Empty	NG	THM	100.0000		NA	
Empty	NG NG		100.0000 100.0000	0.0	NA NA	
Empty	NG		100.0000	0.0	NA	
Fuel Types: NG=	Nat.G	as FO=	Fuel Oil PR=	Propan	e RH=Rmt Htg	
ELECTRIC RATE						
Electric rate. Average buildi	ng po	 wer fac	: Sierra tor.: NA	Pacifi	c Power Company	
FUEL RATES						
Natural gas Fuel oil Propane Remote source Remote source	 heati		: Hawthor: None: None	ne - L	S No. 2 Fuel Oil	
MISCELLANEOUS D.	ATA					
Additional bui Source electric	lding c gene	floor a	area efficiency	• • • • • • •	0.0 s	

Prepared by: 1			•				12-20-94 Page 1
BUILDING NAME	•						
PLANT SELECTION	ОМ						
Plant Na	ne			Туре	Quant:	ity	
24. 117-5 Wor 25. 117-5 Str	ck Rm A	A/C-DX Tol AC-10	Unit R2 (A, 001 R2 (H)	/C DX C	CLG) 1 ER) 1		
MISCELLANEOUS	ELECTE	RIC POWI	ER USE				
			Max. Powe				
Reference Name				(kW)	Schedule	Name	
Empty				0.0	NA NA		
Empty Empty				0.0	NA NA		
Empty				0.0	NA		
MISCELLANEOUS	FUEL U	SE					
Reference Name			Conversion kBTU/Units		Schedule	Name	
Empty	NG	THM	100.0000		NA		-
Empty	NG NG	THM THM	100.0000	0.0	NA NA		
Empty Empty	NG		100.0000 100.0000	0.0			
Fuel Types: NG	=Nat.G	as FO=	Fuel Oil PR=	Propan	e RH=Rmt	Htg	
ELECTRIC RATE							
Electric rate Average build	ing po	wer fac	: Sierra	Pacifi	c Power Co	mpany	
FUEL RATES							
Natural gas Fuel oil Propane Remote source Remote source	heati	 ng	: Hawthor: None: None	ne - L	S No. 2 Fu	el Oil	
MISCELLANEOUS	DATA						
Additional bu Source electr	ilding ic gen	floor erating	area efficiency	• • • • • • •		0.0 s 100.00 %	qft

Electric rate Sierra Pacific Power Company Average building power factor.: NA	Prepared by: HAP v3.06						12-20-94 Page
Plant Name Type Quantity							
Plant Name	PLANT SELECT	ION					
MISCELLANEOUS ELECTRIC POWER USE	Plant Na	ame				Quantit	
Max. Power Use Reference Name (kW) Schedule Name							
Reference Name	MISCELLANEOUS	ELECTE	RIC POWI	ER USE			
Empty 0.0 NA Empty 0.0 NA Empty 0.0 NA Empty 0.0 NA Empty 0.0 NA Empty 0.0 NA MISCELLANEOUS FUEL USE Reference Fuel Fuel Conversion Max. Name Type Units kBTU/Units Use Schedule Name Empty NG THM 100.0000 0.0 NA Empty NG THM 100.0000 0.0 NA Empty NG THM 100.0000 0.0 NA Empty NG THM 100.0000 0.0 NA Empty NG THM 100.0000 0.0 NA Empty NG THM 100.0000 0.0 NA Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg ELECTRIC RATE Electric rate: Sierra Pacific Power Company Average building power factor: NA FUEL RATES Natural gas None Fuel oil None Remote source heating None Remote source cooling None Remote source cooling None Remote source cooling None MISCELLANEOUS DATA Additional building floor area 0.0 sqft	Reference Nam	ie			ower Use		
MISCELLANEOUS FUEL USE	Empty				0.0		
MISCELLANEOUS FUEL USE Reference Fuel Fuel Conversion Max. Name Type Units kBTU/Units Use Schedule Name Empty NG THM 100.0000 0.0 NA Empty NG THM 100.0000 0.0 NA Empty NG THM 100.0000 0.0 NA Empty NG THM 100.0000 0.0 NA Empty NG THM 100.0000 0.0 NA Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg ELECTRIC RATE Electric rate	Empty				0.0	NA	
Reference Fuel Fuel Conversion Max. Name Type Units kBTU/Units Use Schedule Name Empty NG THM 100.0000 0.0 NA Empty NG THM 100.0000 0.0 NA Empty NG THM 100.0000 0.0 NA Empty NG THM 100.0000 0.0 NA Empty NG THM 100.0000 0.0 NA Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg ELECTRIC RATE Electric rate: Sierra Pacific Power Company Average building power factor:: NA FUEL RATES Natural gas: None Fuel oil: None Remote source heating: None Remote source cooling: None MISCELLANEOUS DATA Additional building floor area: 0.0 sqft	Empty					NA ·	
Name Type Units kBTU/Units Use Schedule Name Empty NG THM 100.0000 0.0 NA Empty NG THM 100.0000 0.0 NA Empty NG THM 100.0000 0.0 NA Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg ELECTRIC RATE Electric rate Sierra Pacific Power Company Average building power factor: NA FUEL RATES None Hawthorne - LS No. 2 Fuel Oil Propane	MISCELLANEOUS	FUEL U	SE				
Empty NG THM 100.0000 0.0 NA Empty NG THM 100.0000 0.0 NA Empty NG THM 100.0000 0.0 NA Empty NG THM 100.0000 0.0 NA Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg ELECTRIC RATE Electric rate: Sierra Pacific Power Company Average building power factor.: NA FUEL RATES Natural gas None Fuel oil						Schedule Na	ame
Empty NG THM 100.0000 0.0 NA Empty NG THM 100.0000 0.0 NA Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg ELECTRIC RATE Electric rate: Sierra Pacific Power Company Average building power factor.: NA FUEL RATES Natural gas: None Fuel oil							
Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg ELECTRIC RATE Electric rate: Sierra Pacific Power Company Average building power factor.: NA FUEL RATES Natural gas: None Fuel oil	Empty	NG	THM	100.000	0.0	NA	
ELECTRIC RATE Electric rate: Sierra Pacific Power Company Average building power factor: NA FUEL RATES Natural gas: None Fuel oil: Hawthorne - LS No. 2 Fuel Oil Propane: None Remote source heating: None Remote source cooling: None MISCELLANEOUS DATA Additional building floor area: 0.0 sqft							
Electric rate: Sierra Pacific Power Company Average building power factor.: NA FUEL RATES Natural gas	Fuel Types: N	G=Nat.G 	as FO=	Fuel Oil	PR=Propan	e RH=Rmt Ht	.g
Average building power factor:: NA FUEL RATES Natural gas: None Fuel oil: Hawthorne - LS No. 2 Fuel Oil Propane: None Remote source heating: None Remote source cooling: None MISCELLANEOUS DATA Additional building floor area: 0.0 sqft	ELECTRIC RATE						
Natural gas: None Fuel oil: Hawthorne - LS No. 2 Fuel Oil Propane: None Remote source heating: None Remote source cooling: None MISCELLANEOUS DATA Additional building floor area	Electric rat Average buil	eding po	wer fac	: Sier	ra Pacifi	c Power Comp	pany
Natural gas: None Fuel oil: Hawthorne - LS No. 2 Fuel Oil Propane: None Remote source heating: None Remote source cooling: None MISCELLANEOUS DATA Additional building floor area: 0.0 sqft	FUEL RATES						
MISCELLANEOUS DATA Additional building floor area	Fuel oil Propane Remote source	heati	ng	: None: Hawth: None: None	norne - L	S No. 2 Fuel	•
Additional building floor area 0.0 sqft	MISCELLANEOUS	DATA	 -				
				area	• • • • • • • •	:	0.0 sqft

BUILDING INPUT DATA Prepared by: Keller & Gannon HAP v3.06 ************************************	12-20-94 Page 1
BUILDING NAME 117-5. Mech Room & WCs BL	
PLANT SELECTION	
Plant Name Type Quantity	
10. 117-5 Non Egy Use DX Unit BL (A/C DX CLG) 1 30. 117-5 Stm-Glycol AC-1002 BL (HW BOILER) 1	
MISCELLANEOUS ELECTRIC POWER USE	
Max. Power Use Reference Name (kW) Schedule Name	
Empty 0.0 NA Empty 0.0 NA Empty 0.0 NA Empty 0.0 NA Empty 0.0 NA	
MISCELLANEOUS FUEL USE	
Reference Fuel Fuel Conversion Max. Name Type Units kBTU/Units Use Schedule Name	
Empty NG THM 100.0000 0.0 NA Empty NG THM 100.0000 0.0 NA Empty NG THM 100.0000 0.0 NA Empty NG THM 100.0000 0.0 NA	
Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg	
ELECTRIC RATE	
Electric rate Sierra Pacific Power Company Average building power factor.: NA	
FUEL RATES	
Natural gas	
MISCELLANEOUS DATA	
Additional building floor area 0.0 Source electric generating efficiency 100.00	0 sqft 0 %

December 3 1			BUILDING IN	PUT DAT	A	
Prepared by HAP v3.06 *******					******	12-20-94 Page 1
BUILDING NA	ME	: 1	17-5. Mech Ro	oom & W	Cs R1	
PLANT SELECT	rion					
Plant 1	Name				Quantity	
21. 117-5 1 32. 117-5 S	Non Egy Stm-Glyco	Use DX	Unit R1 (A 002 R1 (H	A/C DX (CLG) 1	
MISCELLANEOU	JS ELECTI	RIC POW	ER USE			
Defense W			Max. Pow	er Use		
Reference Na				(kW)	Schedule Name	
Empty Empty				0.0	NA	
Empty		•		0.0	NA NA	
Empty				0.0	NA	
MISCELLANEOU	S FUEL U	JSE				
Reference Name	Fuel Type		Conversion kBTU/Units	Max.	Schedule Name	
Empty	NG	THM	100.0000	0.0	NA	,
Empty	NG NG	THM THM	100.0000 100.0000	0.0	NA NA	
Empty	NG		100.0000	0.0	NA	
Fuel Types:	NG=Nat.G	as FO=	Fuel Oil PR	=Propan	e RH=Rmt Htg	
ELECTRIC RAT	 E		~~~~~~~			.
Electric rat Average bui	te lding po	 wer fac	: Sierra tor.: NA	Pacifi	c Power Company	
FUEL RATES						
Natural gas. Fuel oil Propane Remote source Remote source	ce heati	 	: Hawthor: None: None	rne - Ls	S No. 2 Fuel Oil	
MISCELLANEOUS	DATA					
Additional b Source elect	uilding ric gene	floor a	rea efficiency			sqft %

RIITI.DING INPIIT DATA

Prepared by: Ko					·*****	12-20-94 Page 1
BUILDING NAME.						
PLANT SELECTION	v					
Plant Name					Quantity	
22. 117-5 Non 34. 117-5 Stm-	-Glyco	1 AC-10	002 R2 (H)	W BOILE	CLG) 1 ER) 1	
MISCELLANEOUS I	ELECTR	IC POWE	R USE			
			Max. Powe			
Reference Name				(kW)	Schedule Name	
Empty				0.0	NA NA	
Empty				0.0 0.0	NA NA	
Empty				0.0	NA	
MISCELLANEOUS F	UEL U	SE 				
	Type		Conversion kBTU/Units		Schedule Name	
Empty	NG	THM	100.0000		NA	
Empty Empty	NG NG	THM THM	100.0000 100.0000	0.0	NA NA	
Empty			100.0000			
Fuel Types: NG=	Nat.G	as FO=	Fuel Oil PR=	Propan	e RH=Rmt Htg	
ELECTRIC RATE						
Electric rate. Average buildi	ng pov	ver fac	: Sierra tor.: NA	Pacifi	c Power Company	
FUEL RATES						
Natural gas Fuel oil Propane Remote source Remote source	heatir	ig	: Hawthor : None : None	ne - L	S No. 2 Fuel Oil	
MISCELLANEOUS D.	ATA	<u> </u>				
Additional bui Source electric	c gene	rating	area	• • • • • •		sqft %

BUILDING INPUT DATA

Prepared by	: Keller	& Gann	BUILDING IN	PUT DAT	A	12-20-04
HAP v3.06				*****	******	12-20-94 Page 1
BUILDING NAI	ME	: 1	17-5. Mech Ro	om & Wo	Cs R3	
PLANT SELECT						
Plant 1					Quantity	
23. 117-5 N 36. 117-5 S	Non Egy U Stm-Glyco	se DX (Jnit R3 (A 002 R3 (H	/C DX (CLG) 1	
MISCELLANEOU	JS ELECTR	IC POWI	ER USE			
Reference Na			Max. Pow			
Empty Empty			·	0.0	NA	
Empty				0.0 0.0	NA NA	
Empty				0.0 	NA	
MISCELLANEOU	S FUEL U	SE				
Reference Name	Fuel Type	Fuel Units	Conversion kBTU/Units	Max. Use	Schedule Name	
Empty	NG	THM	100.0000	0.0	NA	
Empty	NG NG	THM THM	100.0000 100.0000	0.0 0.0	NA NA	
Empty	NG	THM	100.0000	0.0	NA	
Fuel Types:	NG=Nat.Ga	as FO=	Fuel Oil PR	=Propan	e RH=Rmt Htg	
ELECTRIC RATE	_				*****************	
Electric rat Average buil	te	ver fac	: Sierra tor.: NA	Pacifi	c Power Company	
FUEL RATES) W = = w =
Natural gas. Fuel oil Propane Remote source Remote source	ce heatin	••••••••••••••••••••••••••••••••••••••	None Hawthor None None None None	ne – Ls	S No. 2 Fuel Oil	
MISCELLANEOUS	DATA					
Additional b Source elect	uilding ric gene	floor a	rea			sqft \$

Building: Srvcs&Supprt ACTUAL 117-1 BL

11-07-94 HAP v3.06 Page 1 of 1

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	425307	46.325
Heating Loads	562741	61.294

TABLE 2. ENERGY CONSUMPTION BY SYSTEM COMPONENT

Component	< Site (kBTU)	Energy *> (kBTU/sqft)*	< Source (kBTU)	Energy *> (kBTU/sqft)*
Air System Fans Cooling Plants Absorption Chille Heating Plants Pumps Cooling Towers	180024 140714 rs 0 1014201 11149	19.608 15.327 0.000 110.467 1.214 0.000	180024 140714 0 1014201 11149 0	19.608 15.327 0.000 110.467 1.214 0.000
>>> HVAC Total	1346087	146.617	1346087	146.617
Lights Electric Equipmen Misc. Electric Misc. Fuel Use	319714 t 527638 0	34.823 57.471 0.000 0.000	319714 527638 0 0	34.823 57.471 0.000 0.000
>>> Non-HVAC Tota	1 847352	92.294	847352	92.294
>>> GRAND TOTAL	2193439	238.911	2193439	238.911

^{*} Site Energy is the actual energy consumed. * Source Energy is the site energy divided by the electric generating efficiency of 100.0 %

^{*} Cost per unit floor area is based on the gross building floor area.

Building: Srvcs&Supprt ACTUAL 117-1 BL

11-07-94 HAP v3.06

Page 1 of 1

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	425307	46.325
Heating Loads	562741	61.294

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

Component	< Site (kBTU)	Energy *> (kBTU/sqft)*	< Source (kBTU)	Energy *> (kBTU/sqft)*
Electric Natural Gas Fuel Oil Propane Remote Heating Remote Cooling	356779 0 989308 0 0	38.861 0.000 107.756 0.000 0.000	356779 0 989308 0 0	38.861 0.000 107.756 0.000 0.000
>>> HVAC Total	1346087	146.617	1346087	146.617
Electric Natural Gas Fuel Oil Propane Remote Heating	847352 0 0 0 0	92.294 0.000 0.000 0.000 0.000	847352 0 0 0 0	92.294 0.000 0.000 0.000 0.000
>>> Non-HVAC Tota	1 847352	92.294	847352	92.294
>>> GRAND TOTAL	2193439	238.911	2193439	238.911

^{*} Site Energy is the actual energy consumed.

^{*} Source Energy is the site energy divided by the electric generating efficiency of 100.0 %

^{*} Cost per unit floor area is based on the gross building floor area.

Building: Srvcs&Supprt ACTUAL 117-1 R1

Weather: Hawthorne (Reno TMY)
Prepared by: Keller & Gannon

11-07-94 HAP v3.06 Page 1 of 1

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	255797	27.862
Heating Loads	374090	40.746

TABLE 2. ENERGY CONSUMPTION BY SYSTEM COMPONENT

<pre>Component</pre>		Energy *> (kBTU/sqft) *	< Source (kBTU)	Energy *> (kBTU/sqft)*
Air System Fans Cooling Plants Absorption Chiller Heating Plants Pumps Cooling Towers	182856 93228 s 0 664642 11149	19.917 10.154 0.000 72.393 1.214 0.000	182856 93228 0 664642 11149 0	19.917 10.154 0.000 72.393 1.214 0.000
>>> HVAC Total	951875	103.679	951875	103.679
Lights Electric Equipment Misc. Electric Misc. Fuel Use	319714 527638 0 0	34.823 57.471 0.000 0.000	319714 527638 0 0	34.823 57.471 0.000 0.000
>>> Non-HVAC Total	847352	92.294	847352	92.294
>>> GRAND TOTAL	1799226	195.973	1799226	195.973

^{*} Site Energy is the actual energy consumed. * Source Energy is the site energy divided by the electric

generating efficiency of 100.0 % * Cost per unit floor area is based on the gross building floor area.

Building: Srvcs&Supprt ACTUAL 117-1 R1

Weather: Hawthorne (Reno TMY) Prepared by: Keller & Gannon

11-07-94 HAP v3.06

Page 1 of 1 ***********************

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	255797	27.862
Heating Loads	374090	40.746

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

Component	< Site (kBTU)	Energy *> (kBTU/sqft)*	< Source (kBTU)	Energy *> (kBTU/sqft)*
Electric Natural Gas Fuel Oil Propane Remote Heating Remote Cooling	312108 0 639767 0 0	33.995 0.000 69.684 0.000 0.000	312108 0 639767 0 0 0	33.995 0.000 69.684 0.000 0.000
>>> HVAC Total	951875	103.679	951875	103.679
Electric Natural Gas Fuel Oil Propane Remote Heating	847352 0 0 0 0	92.294 0.000 0.000 0.000 0.000	847352 0 0 0 0	92.294 0.000 0.000 0.000 0.000
>>> Non-HVAC Tota	1 847352	92.294	847352	92.294
>>> GRAND TOTAL	1799227	195.973	1799227	195.973

^{*} Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric

DESIGN BASELINE

ENERGY BUDGET BY SYSTEM COMPONENT

11-01-94 Building: Services & Support Bldg. 117-1 HAP v3.06

Page 1 of 1

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	311484	33.927
Heating Loads	578600	63.021

TABLE 2. ENERGY CONSUMPTION BY SYSTEM COMPONENT

Component		Energy *> (kBTU/sqft)*	< Source (kBTU)	Energy *> (kBTU/sqft)*
Air System Fans Cooling Plants Absorption Chille Heating Plants Pumps Cooling Towers	172267 104352 rs 0 1043662 11149	18.763 11.366 0.000 113.676 1.214 0.000	172267 104352 0 1043662 11149 0	18.763 11.366 0.000 113.676 1.214 0.000
>>> HVAC Total	1331430	145.020	1331430	145.020
Lights Electric Equipmen Misc. Electric Misc. Fuel Use	319714 t 527638 0	34.823 57.471 0.000 0.000	319714 527638 0 0	34.823 57.471 0.000 0.000
>>> Non-HVAC Tota	1 847352	92.294	847352	92.294
>>> GRAND TOTAL	2178782	237.314	2178782	237.314

^{*} Site Energy is the actual energy consumed.

* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %

* Cost per floor area is based on the gross building floor area.

DESIGN BASELINE

ENERGY BUDGET BY ENERGY SOURCE

Building: Services & Support Bldg. 117-1 11-01-94 Weather: Hawthorne (Reno TMY) Prepared by: Keller & Gannon HAP v3.06 Page 1 of 1 **************

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	311484	33.927
Heating Loads	578600	63.021

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

Component	< Site (kBTU)	Energy *> (kBTU/sqft) *	< Source (kBTU)	Energy *> (kBTU/sqft)*
Electric Natural Gas Fuel Oil Propane Remote Heating Remote Cooling	312662 0 1018768 0 0	34.055 0.000 110.965 0.000 0.000	312662 0 1018768 0 0	34.055 0.000 110.965 0.000 0.000
>>> HVAC Total	1331430	145.020	1331430	145.020
Electric Natural Gas Fuel Oil Propane Remote Heating	847352 0 0 0 0	92.294 0.000 0.000 0.000 0.000	847352 0 0 0 0	92.294 0.000 0.000 0.000 0.000
>>> Non-HVAC Tota	al 847352	92.294	847352	92.294
>>> GRAND TOTAL	2178782	237.314	2178782	237.314

^{*} Site Energy is the actual energy consumed.

^{*} Source Energy is the site energy divided by the electric

generating efficiency of 100.0 % * Cost per unit floor area is based on the gross building floor area.

Building: 117-3. Control Room Area BL 11-08-94 HAP v3.06 Page 1 of 1

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	63601	37.172
Heating Loads	54405	31.797

TABLE 2. ENERGY CONSUMPTION BY SYSTEM COMPONENT

Component		Energy *> (kBTU/sqft)*	< Source (kBTU)	Energy *> (kBTU/sqft)*
Air System Fans Cooling Plants Absorption Chille: Heating Plants Pumps Cooling Towers	26514 19699 rs 0 84373 17171	15.496 11.513 0.000 49.312 10.036 0.000	26514 19699 0 84373 17171 0	15.496 11.513 0.000 49.312 10.036 0.000
>>> HVAC Total	147757	86.357	147757	86.357
Lights Electric Equipment Misc. Electric Misc. Fuel Use	68896 76064 0	40.266 44.456 0.000 0.000	68896 76064 0 0	40.266 44.456 0.000 0.000
>>> Non-HVAC Total	144960	84.722	144960	84.722
>>> GRAND TOTAL	292717	171.080	292717	171.080

^{*} Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %

^{*} Cost per unit floor area is based on the gross building floor area. Gross floor area...... 1711 sqft Conditioned floor area....: 1711 sqft

Building: 117-3. Control Room Area BL

11-08-94 HAP v3.06 Page 1 of 1

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	63601	37.172
Heating Loads	54405	31.797

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

Component	< Site (kBTU)	Energy *> (kBTU/sqft)*	< Source (kBTU)	Energy *> (kBTU/sqft)*
Electric Natural Gas Fuel Oil Propane Remote Heating Remote Cooling	63389 0 84368 0 0	37.048 0.000 49.309 0.000 0.000	63389 0 84368 0 0	37.048 0.000 49.309 0.000 0.000
>>> HVAC Total	147757	86.357	147757	86.357
Electric Natural Gas Fuel Oil Propane Remote Heating	144960 0 0 0 0	84.722 0.000 0.000 0.000 0.000	144960 0 0 0 0	84.722 0.000 0.000 0.000 0.000
>>> Non-HVAC Tota	144960	84.722	144960	84.722
>>> GRAND TOTAL	292717	171.080	292717	171.080

^{*} Site Energy is the actual energy consumed.

Conditioned floor area....: 1711 sqft

^{*} Source Energy is the site energy divided by the electric generating efficiency of 100.0 %

^{*} Cost per unit floor area is based on the gross building floor area.

Building: 117-3. Control Room Area R1

Weather: Hawthorne (Reno TMY)

11-08-94 HAP v3.06

Page 1 of 1 Prepared by: Keller & Gannon _____

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	48760	28.498
Heating Loads	53562	31.305

TABLE 2. ENERGY CONSUMPTION BY SYSTEM COMPONENT

Component		<pre>Energy *> (kBTU/sqft) *</pre>		<pre>Energy *> (kBTU/sqft) *</pre>
Air System Fans Cooling Plants Absorption Chille Heating Plants Pumps Cooling Towers	26514 15804 rs 0 82135 16942	15.496 9.237 0.000 48.004 9.902 0.000	26514 15804 0 82135 16942 0	15.496 9.237 0.000 48.004 9.902 0.000
>>> HVAC Total	141395	82.639	141395	82.639
Lights Electric Equipmen Misc. Electric Misc. Fuel Use	68896 t 76064 0	40.266 44.456 0.000 0.000	68896 76064 0 0	40.266 44.456 0.000 0.000
>>> Non-HVAC Tota	1 144960	84.722	144960	84.722
>>> GRAND TOTAL	286355	167.361	286355	167.361

Gross floor area.....: 1711 sqft Conditioned floor area....: 1711 sqft

^{*} Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %

^{*} Cost per unit floor area is based on the gross building floor area.

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	48760	28.498
Heating Loads	53562	31.305

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

Component	< Site (kBTU)	Energy *> (kBTU/sqft)*	< Source (kBTU)	Energy *> (kBTU/sqft)*
Electric Natural Gas Fuel Oil Propane Remote Heating Remote Cooling	59264 0 82131 0 0	34.637 0.000 48.002 0.000 0.000	59264 0 82131 0 0	34.637 0.000 48.002 0.000 0.000
>>> HVAC Total	141395	82.639	141395	82.639
Electric Natural Gas Fuel Oil Propane Remote Heating	144960 0 0 0 0	84.722 0.000 0.000 0.000 0.000	144960 0 0 0 0	84.722 0.000 0.000 0.000 0.000
>>> Non-HVAC Tota	1 144960	84.722	144960	84.722
>>> GRAND TOTAL	286355	167.361	286355	167.361

^{*} Site Energy is the actual energy consumed.

^{*} Source Energy is the site energy divided by the electric generating efficiency of 100.0 %

^{*} Cost per unit floor area is based on the gross building floor area.

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads Heating Loads	601501 145921	64.664 15.687

TABLE 2. ENERGY CONSUMPTION BY SYSTEM COMPONENT

Component	< Site (kBTU)	Energy *> (kBTU/sqft)*	< Source (kBTU)	Energy *> (kBTU/sqft)*
Air System Fans Cooling Plants Absorption Chille Heating Plants Pumps Cooling Towers	63736 72712 rs 0 232778 56755	6.852 7.817 0.000 25.025 6.101 0.000	63736 72712 0 232778 56755 0	6.852 7.817 0.000 25.025 6.101 0.000
>>> HVAC Total	425982	45.795	425982	45.795
Lights Electric Equipment Misc. Electric Misc. Fuel Use	266135 t 1215471 0 0	28.610 130.668 0.000 0.000	266135 1215471 0 0	28.610 130.668 0.000 0.000
>>> Non-HVAC Total	l 1481606	159.278	1481606	159.278
>>> GRAND TOTAL	1907588	205.073	1907588	205.073

^{*} Site Energy is the actual energy consumed.

Gross floor area..... 9302 sqft Conditioned floor area..... 9302 sqft

^{*} Source Energy is the site energy divided by the electric generating efficiency of 100.0 %

^{*} Cost per unit floor area is based on the gross building floor area.

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	601501	64.664
Heating Loads	145921	15.687

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

Component	< Site (kBTU)	Energy *> (kBTU/sqft)*	< Source (kBTU)	Energy *> (kBTU/sqft)*
Electric Natural Gas	193215	20.771	193215	20.771 0.000
Fuel Oil	232766	25.023	232766	25.023
Propane Remote Heating	0	0.000 0.000	0 0	0.000 0.000
Remote Cooling	0	0.000	0 	0.000
>>> HVAC Total	425982	45.795	425982	45.795
Electric	1481606	159.278	1481606	159.278
Natural Gas Fuel Oil	0	0.000 0.000	0	0.000 0.000
Propane Remote Heating	0	0.000 0.000	0	0.000 0.000
>>> Non-HVAC Tota	l 1481606	159.278	1481606	159.278
>>> GRAND TOTAL	1907588	205.073	1907588	205.073

^{*} Site Energy is the actual energy consumed.

Gross floor area...... 9302 sqft Conditioned floor area..... 9302 sqft

^{*} Source Energy is the site energy divided by the electric generating efficiency of 100.0 %

^{*} Cost per unit floor area is based on the gross building floor area.

Building: 117-3. Work Areas R1 11-23-94
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TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	483293	51.956
Heating Loads	88944	9.562

TABLE 2. ENERGY CONSUMPTION BY SYSTEM COMPONENT

Component	< Site (kBTU)	Energy *> (kBTU/sqft)*	< Source (kBTU)	Energy *> (kBTU/sqft)*
Air System Fans Cooling Plants Absorption Chille Heating Plants Pumps Cooling Towers	63736 70043 rs 0 136883 56755	6.852 7.530 0.000 14.715 6.101 0.000	63736 70043 0 136883 56755 0	6.852 7.530 0.000 14.715 6.101 0.000
>>> HVAC Total	327417	35.199	327417	35.199
Lights Electric Equipmen Misc. Electric Misc. Fuel Use	266135 t 1215471 0	28.610 130.668 0.000 0.000	266135 1215471 0 0	28.610 130.668 0.000 0.000
>>> Non-HVAC Tota	1 1481606	159.278	1481606	159.278
>>> GRAND TOTAL	1809023	194.477	1809023	194.477

^{*} Site Energy is the actual energy consumed.

Gross floor area...... 9302 sqft Conditioned floor area..... 9302 sqft

^{*} Source Energy is the site energy divided by the electric generating efficiency of 100.0 %

^{*} Cost per unit floor area is based on the gross building floor area.

Building: 117-3. Work Areas R1 Weather: Hawthorne (Reno TMY) Prepared by: Keller & Gannon 11-23-94 HAP v3.06

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft) *	
Cooling Loads	483293	51.956	
Heating Loads	88944	9.562	

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

Component	< Site (kBTU)	Energy *> (kBTU/sqft)*	< Source (kBTU)	Energy *> (kBTU/sqft)*
Electric Natural Gas Fuel Oil Propane Remote Heating Remote Cooling	190541 0 136876 0 0	20.484 0.000 14.715 0.000 0.000	190541 0 136876 0 0	20.484 0.000 14.715 0.000 0.000
>>> HVAC Total	327417	35.199	327417	35.199
Electric Natural Gas Fuel Oil Propane Remote Heating	1481606 0 0 0 0	159.278 0.000 0.000 0.000 0.000	1481606 0 0 0 0	159.278 0.000 0.000 0.000 0.000
>>> Non-HVAC Tota	1 1481606	159.278	1481606	159.278
>>> GRAND TOTAL	1809024	194.477	1809024	194.477

^{*} Site Energy is the actual energy consumed.

Gross floor area..... 9302 sqft
Conditioned floor area..... 9302 sqft

^{*} Source Energy is the site energy divided by the electric generating efficiency of 100.0 %

^{*} Cost per unit floor area is based on the gross building floor area.

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*	
Cooling Loads	525347	56.477	_
Heating Loads	50311	5.409	

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

Component	< Site (kBTU)	Energy *> (kBTU/sqft)*	< Source (kBTU)	Energy *> (kBTU/sqft)*
Electric	225564	24.249	225564	24.249
Natural Gas	0	0.000	0	0.000
Fuel Oil	72532	7.797	72532	7.797
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
Remote Cooling	0	0.000	0	0.000
>>> HVAC Total	298096	32.046	298096	32.046
Electric	1481606	159.278	1481606	159.278
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
>>> Non-HVAC Tota	1 1481606	159.278	1481606	159.278
>>> GRAND TOTAL	1779702	191.325	1779702	191.325

^{*} Site Energy is the actual energy consumed.

^{*} Source Energy is the site energy divided by the electric generating efficiency of 100.0 %

^{*} Cost per unit floor area is based on the gross building floor area.

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	525347	56.477
Heating Loads	50311	5.409

TABLE 2. ENERGY CONSUMPTION BY SYSTEM COMPONENT

Component	< Site (kBTU)	Energy *> (kBTU/sqft)*	< Source (kBTU)	Energy *> (kBTU/sqft)*
Air System Fans Cooling Plants Absorption Chille Heating Plants Pumps Cooling Towers	97022 71783 ers 0 72536 56755	10.430 7.717 0.000 7.798 6.101 0.000	97022 71783 0 72536 56755	10.430 7.717 0.000 7.798 6.101 0.000
>>> HVAC Total	298096	32.046	298096	32.046
Lights Electric Equipment Misc. Electric Misc. Fuel Use	266135 t 1215471 0 0	28.610 130.668 0.000 0.000	266135 1215471 0 0	28.610 130.668 0.000 0.000
>>> Non-HVAC Total	l 1481606	159.278	1481606	159.278
>>> GRAND TOTAL	1779702	191.325	1779702	191.325

^{*} Site Energy is the actual energy consumed.

^{*} Source Energy is the site energy divided by the electric generating efficiency of 100.0 %

^{*} Cost per unit floor area is based on the gross building floor area.

Building: 117-3. Work Areas R2B Weather: Hawthorne (Reno TMY)

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TABLE 1. ANNUAL COIL LOADS

Prepared by: Keller & Gannon

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	484213	52.055
Heating Loads	879	0.094

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

Component	< Site (kBTU)	Energy *> (kBTU/sqft)*	< Source (kBTU)	Energy *> (kBTU/sqft)*
Electric	191702	20.609	191702	20.609
Natural Gas	0	0.000	0	0.000
Fuel Oil	970	0.104	970	0.104
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
Remote Cooling	0	0.000	0	0.000
>>> HVAC Total	192672	20.713	192672	20.713
Electric	1481606	159.278	1481606	159.278
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
>>> Non-HVAC Tota	1 1481606	159.278	1481606	159.278
>>> GRAND TOTAL	1674279	179.991	1674279	179.991

^{*} Site Energy is the actual energy consumed.

Gross floor area...... 9302 sqft
Conditioned floor area..... 9302 sqft

^{*} Source Energy is the site energy divided by the electric generating efficiency of 100.0 %

^{*} Cost per unit floor area is based on the gross building floor area.

Building: 117-3. Work Areas R2B Weather: Hawthorne (Reno TMY)

11-23-94 HAP v3.06

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU) (kBTU/sqft		
Cooling Loads	484213	52.055	
Heating Loads	879	0.094	

TABLE 2. ENERGY CONSUMPTION BY SYSTEM COMPONENT

Component	< Site (kBTU)	Energy *> (kBTU/sqft)*	< Source (kBTU)	Energy *> (kBTU/sqft)*
Air System Fans Cooling Plants Absorption Chille Heating Plants Pumps Cooling Towers	64804 70144 rs 0 970 56755	6.967 7.541 0.000 0.104 6.101 0.000	64804 70144 0 970 56755	6.967 7.541 0.000 0.104 6.101 0.000
>>> HVAC Total	192672	20.713	192672	20.713
Lights Electric Equipmen Misc. Electric Misc. Fuel Use	266135 t 1215471 0 0	28.610 130.668 0.000 0.000	266135 1215471 0 0	28.610 130.668 0.000 0.000
>>> Non-HVAC Tota	1 1481606	159.278	1481606	159.278
>>> GRAND TOTAL	1674278	179.991	1674278	179.991

^{*} Site Energy is the actual energy consumed.

Gross floor area..... 9302 sqft Conditioned floor area..... 9302 sqft

^{*} Source Energy is the site energy divided by the electric generating efficiency of 100.0 %

^{*} Cost per unit floor area is based on the gross building floor area.

Building: 117-3. Mechanical Room BL 11-08-94 Weather: Hawthorne (Reno TMY)
Prepared by: Keller & Gannon HAP v3.06 Page 1 of 1

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	0	0.000
Heating Loads	501425	170.321

TABLE 2. ENERGY CONSUMPTION BY SYSTEM COMPONENT

Component	< Site (kBTU)	Energy *> (kBTU/sqft)*	< Source (kBTU)	Energy *> (kBTU/sqft)*
Air System Fans Cooling Plants Absorption Chille Heating Plants Pumps Cooling Towers	50990 0 rs 0 841306 54214 0	17.320 0.000 0.000 285.770 18.415 0.000	50990 0 0 841306 54214 0	17.320 0.000 0.000 285.770 18.415 0.000
>>> HVAC Total	946510	321.505	946510	321.505
Lights Electric Equipmen Misc. Electric Misc. Fuel Use	57653 t 615955 0	19.583 209.224 0.000 0.000	57653 615955 0 0	19.583 209.224 0.000 0.000
>>> Non-HVAC Tota	1 673607	228.807	673607	228.807
>>> GRAND TOTAL	1620117	550.312	1620117	550.312

^{*} Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %

Building: 117-3. Mechanical Room BL

11-08-94 HAP v3.06

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU) (kBTU/	
Cooling Loads	0	0.000
Heating Loads	501425	170.321

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

Component	< Site (kBTU)	Energy *> (kBTU/sqft)*	< Source (kBTU)	Energy *> (kBTU/sqft)*
Electric Natural Gas Fuel Oil Propane Remote Heating Remote Cooling	105248 0 841262 0 0	35.750 0.000 285.755 0.000 0.000	105248 0 841262 0 0	35.750 0.000 285.755 0.000 0.000
>>> HVAC Total	946510	321.505	946510	321.505
Electric Natural Gas Fuel Oil Propane Remote Heating	673607 0 0 0 0	228.807 0.000 0.000 0.000 0.000	673607 0 0 0 0	228.807 0.000 0.000 0.000 0.000
>>> Non-HVAC Tota	1 673607	228.807	673607	228.807
>>> GRAND TOTAL	1620117	550.311	1620117	550.311

^{*} Site Energy is the actual energy consumed.

Conditioned floor area....: 2944 sqft

^{*} Source Energy is the site energy divided by the electric generating efficiency of 100.0 %

Building: 117-3. Mechanical Room R1

Weather: Hawthorne (Reno TMY)

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Prepared by: Keller & Gannon Page 1 of 1 ______

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	0	0.000
Heating Loads	501312	170.283

TABLE 2. ENERGY CONSUMPTION BY SYSTEM COMPONENT

Component		Energy *> (kBTU/sqft) *	< Source (kBTU)	Energy *> (kBTU/sqft)*
Air System Fans Cooling Plants Absorption Chille Heating Plants Pumps Cooling Towers	50989 0 rs 0 841097 54214 0	17.320 0.000 0.000 285.699 18.415 0.000	50989 0 0 841097 54214 0	17.320 0.000 0.000 285.699 18.415 0.000
>>> HVAC Total	946300	321.433	946300	321.433
Lights Electric Equipmen Misc. Electric Misc. Fuel Use	57653 t 615955 0	19.583 209.224 0.000 0.000	57653 615955 0 0	19.583 209.224 0.000 0.000
>>> Non-HVAC Tota	1 673607	228.807	673607	228.807
>>> GRAND TOTAL	1619907	550.240	1619907	550.240

^{*} Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %

Building: 117-3. Mechanical Room R1 11-08-94 Weather: Hawthorne (Reno TMY) Prepared by: Keller & Gannon HAP v3.06 Page 1 of 1 ***********************

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	0	0.000
Heating Loads	501312	170.283

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

Component	< Site (kBTU)	Energy *> (kBTU/sqft)*	< Source (kBTU)	<pre>Energy *> (kBTU/sqft) *</pre>
Electric Natural Gas Fuel Oil Propane Remote Heating Remote Cooling	105247 0 841053 0 0	35.750 0.000 285.684 0.000 0.000	105247 0 841053 0 0	35.750 0.000 285.684 0.000 0.000
>>> HVAC Total	946300	321.433	946300	321.433
Electric Natural Gas Fuel Oil Propane Remote Heating	673607 0 0 0 0	228.807 0.000 0.000 0.000 0.000	673607 0 0 0 0	228.807 0.000 0.000 0.000 0.000
>>> Non-HVAC Tota	1 673607	228.807	673607	228.807
>>> GRAND TOTAL	1619907	550.240	1619907	550.240

^{*} Site Energy is the actual energy consumed.

2944 sqft

^{*} Source Energy is the site energy divided by the electric generating efficiency of 100.0 %

11-08-94 Building: 117-5. Work Room HVAC BL HAP v3.06 Page 1 of 1

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*	_
Cooling Loads	304859	82.865	_
Heating Loads	1806123	490.928	

TABLE 2. ENERGY CONSUMPTION BY SYSTEM COMPONENT

Component		<pre>Energy *> (kBTU/sqft) *</pre>	< Source (kBTU)	Energy *> (kBTU/sqft)*
Air System Fans Cooling Plants Absorption Chille Heating Plants Pumps Cooling Towers	116280 131219 ers 0 3313633 24530	31.606 35.667 0.000 900.688 6.668 0.000	116280 131219 0 3313633 24530 0	31.606 35.667 0.000 900.688 6.668 0.000
>>> HVAC Total	3585662	974.630	3585662	974.630
Lights Electric Equipmen Misc. Electric Misc. Fuel Use	261980 t 440049 0	71.210 119.611 0.000 0.000	261980 440049 0 0	71.210 119.611 0.000 0.000
>>> Non-HVAC Tota	1 702029	190.821	702029	190.821
>>> GRAND TOTAL	4287692	1165.450	4287692	1165.450

Gross floor area..... 3679 sqft 3679 sqft Conditioned floor area....:

^{*} Site Energy is the actual energy consumed.

* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %

* Cost per floor area is based on the gross building floor area.

Building: 117-5. Work Room HVAC BL 11-08-94 Weather: Hawthorne (Reno TMY) Prepared by: Keller & Gannon HAP v3.06 Page 1 of 1 *********************

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU) (kBTU/sqft)*		
Cooling Loads	304859	82.865	
Heating Loads	1806123	490.928	

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

Component	< Site (kBTU)	Energy *> (kBTU/sqft)*	< Source (kBTU)	Energy *> (kBTU/sqft)*
Electric Natural Gas Fuel Oil Propane Remote Heating Remote Cooling	272202 0 3313460 0 0	73.988 0.000 900.641 0.000 0.000	272202 0 3313460 0 0	73.988 0.000 900.641 0.000 0.000
>>> HVAC Total	3585662	974.629	3585662	974.629
Electric Natural Gas Fuel Oil Propane Remote Heating	702029 0 0 0 0	190.821 0.000 0.000 0.000 0.000	702029 0 0 0 0	190.821 0.000 0.000 0.000 0.000
>>> Non-HVAC Tota	1 702029	190.821	702029	190.821
>>> GRAND TOTAL	4287691	1165.450	4287691	1165.450

^{*} Site Energy is the actual energy consumed.

* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %

11-08-94 Building: 117-5. Work Room HVAC R1 HAP v3.06 Weather: Hawthorne (Reno TMY) Prepared by: Keller & Gannon Page 1 of 1

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	205594	55.883
Heating Loads	1044759	283.979

TABLE 2. ENERGY CONSUMPTION BY SYSTEM COMPONENT

Component		Energy *> (kBTU/sqft) *	< Source (kBTU)	Energy *> (kBTU/sqft)*
Air System Fans Cooling Plants Absorption Chille Heating Plants Pumps Cooling Towers	100671 93303 ers 0 1907481 20160	27.364 25.361 0.000 518.478 5.480 0.000	100671 93303 0 1907481 20160 0	27.364 25.361 0.000 518.478 5.480 0.000
>>> HVAC Total	2121616	576.683	2121616	576.683
Lights Electric Equipmen Misc. Electric Misc. Fuel Use	261980 t 440049 0	71.210 119.611 0.000 0.000	261980 440049 0 0	71.210 119.611 0.000 0.000
>>> Non-HVAC Tota	1 702029	190.821	702029	190.821
>>> GRAND TOTAL	2823645	767.503	2823645	767.503

^{*} Site Energy is the actual energy consumed.

Gross floor area..... 3679 sqft Conditioned floor area....: 3679 sqft

^{*} Source Energy is the site energy divided by the electric generating efficiency of 100.0 %

^{*} Cost per unit floor area is based on the gross building floor area.

Building: 117-5. Work Room HVAC R1 11-08-94 Weather: Hawthorne (Reno TMY) Prepared by: Keller & Gannon HAP v3.06 Page 1 of 1 **********************

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU) (kBTU/sqft)*		
Cooling Loads	205594	55.883	
Heating Loads	1044759	283.979	

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

Component	< Site (kBTU)	Energy *> (kBTU/sqft)*	< Source (kBTU)	Energy *> (kBTU/sqft)*
Electric Natural Gas Fuel Oil Propane Remote Heating Remote Cooling	214234 0 1907382 0 0	58.232 0.000 518.451 0.000 0.000	214234 0 1907382 0 0	58.232 0.000 518.451 0.000 0.000 0.000
>>> HVAC Total	2121616	576.683	2121616	576.683
Electric Natural Gas Fuel Oil Propane Remote Heating	702029 0 0 0 0	190.821 0.000 0.000 0.000 0.000	702029 0 0 0 0	190.821 0.000 0.000 0.000 0.000
>>> Non-HVAC Tota	1 702029	190.821	702029	190.821
>>> GRAND TOTAL	2823645	767.503	2823645	767.503

Gross floor area..... 3679 sqft Conditioned floor area..... 3679 sqft

^{*} Site Energy is the actual energy consumed.

* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %

* Cost per unit floor area is based on the gross building floor area.

11-08-94 Building: 117-5. Work Room HVAC R2

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*	
Cooling Loads	222933	60.596	
Heating Loads	744205	202.285	

TABLE 2. ENERGY CONSUMPTION BY SYSTEM COMPONENT

Component	< Site (kBTU)	Energy *> (kBTU/sqft) *	< Source (kBTU)	Energy *> (kBTU/sqft)*
Air System Fans Cooling Plants Absorption Chille Heating Plants Pumps Cooling Towers	123151 100345 rs 0 1356073 17200	33.474 27.275 0.000 368.598 4.675 0.000	123151 100345 0 1356073 17200 0	33.474 27.275 0.000 368.598 4.675 0.000
>>> HVAC Total	1596769	434.023	1596769	434.023
Lights Electric Equipmen Misc. Electric Misc. Fuel Use	261980 t 440049 0	71.210 119.611 0.000 0.000	261980 440049 0 0	71.210 119.611 0.000 0.000
>>> Non-HVAC Tota	1 702029	190.821	702029	190.821
>>> GRAND TOTAL	2298799	624.843	2298799	624.843

^{*} Site Energy is the actual energy consumed.

* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %

* Cost per unit floor area is based on the gross building floor area.

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	222933	60.596
Heating Loads	744205	202.285

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

Component	< Site (kBTU)	Energy *> (kBTU/sqft)*	< Source (kBTU)	Energy *> (kBTU/sqft)*
Electric Natural Gas Fuel Oil Propane Remote Heating Remote Cooling	240767 0 1356003 0 0	65.443 0.000 368.579 0.000 0.000	240767 0 1356003 0 0	65.443 0.000 368.579 0.000 0.000
>>> HVAC Total	1596769	434.023	1596769	434.023
Electric Natural Gas Fuel Oil Propane Remote Heating	702029 0 0 0 0	190.821 0.000 0.000 0.000 0.000	702029 0 0 0 0	190.821 0.000 0.000 0.000 0.000
>>> Non-HVAC Tota	1 702029	190.821	702029	190.821
>>> GRAND TOTAL	2298799	624.843	2298799	624.843

^{*} Site Energy is the actual energy consumed.

^{*} Source Energy is the site energy divided by the electric generating efficiency of 100.0 %

^{*} Cost per unit floor area is based on the gross building floor area.

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft) *
Cooling Loads	202082	54.929
Heating Loads	280356	76.204

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

Component	< Site (kBTU)	Energy *> (kBTU/sqft)*	< Source (kBTU)	Energy *> (kBTU/sqft)*
Electric Natural Gas Fuel Oil Propane Remote Heating Remote Cooling	234292 0 499506 0 0	63.683 0.000 135.772 0.000 0.000	234292 0 499506 0 0	63.683 0.000 135.772 0.000 0.000
>>> HVAC Total	733798	199.456	733798	199.456
Electric Natural Gas Fuel Oil Propane Remote Heating	702029 0 0 0 0	190.821 0.000 0.000 0.000 0.000	702029 0 0 0 0	190.821 0.000 0.000 0.000 0.000
>>> Non-HVAC Tota	1 702029	190.821	702029	190.821
>>> GRAND TOTAL	1435827	390.277	1435827	390.277

^{*} Site Energy is the actual energy consumed.

^{*} Source Energy is the site energy divided by the electric generating efficiency of 100.0 %

^{*} Cost per unit floor area is based on the gross building floor area.

Building: 117-5. Work Room HVAC R3 11-08-94 Weather: Hawthorne (Reno TMY)
Prepared by: Keller & Gannon HAP v3.06 Page 1 of 1

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	202082	54.929
Heating Loads	280356	76.204

TABLE 2. ENERGY CONSUMPTION BY SYSTEM COMPONENT

Component	< Site (kBTU)	Energy *> (kBTU/sqft)*	< Source (kBTU)	Energy *> (kBTU/sqft)*
Air System Fans Cooling Plants Absorption Chille Heating Plants Pumps Cooling Towers	125882 91183 ers 0 499532 17200	34.216 24.785 0.000 135.779 4.675 0.000	125882 91183 0 499532 17200	34.216 24.785 0.000 135.779 4.675 0.000
>>> HVAC Total	733798	199.456	733798	199.456
Lights Electric Equipmen Misc. Electric Misc. Fuel Use	261980 t 440049 0	71.210 119.611 0.000 0.000	261980 440049 0 0	71.210 119.611 0.000 0.000
>>> Non-HVAC Tota	1 702029	190.821	702029	190.821
>>> GRAND TOTAL	1435827	390.276	1435827	390.276

^{*} Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %

^{*} Cost per unit floor area is based on the gross building floor area.

Building: 117-5. Mech Room & WCs BL 11-08-94 HAP v3.06

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft) *	
Cooling Loads	4977	1.803	_
Heating Loads	866002	313.792	

TABLE 2. ENERGY CONSUMPTION BY SYSTEM COMPONENT

Component	< Site (kBTU)	Energy *> (kBTU/sqft)*	< Source (kBTU)	<pre>Energy *> (kBTU/sqft) *</pre>
Air System Fans Cooling Plants Absorption Chille Heating Plants Pumps Cooling Towers	67965 1 ers 0 1592014 9854 0	24.627 0.000 0.000 576.859 3.570 0.000	67965 1 0 1592014 9854 0	24.627 0.000 0.000 576.859 3.570 0.000
>>> HVAC Total	1669834	605.056	1669834	605.056
Lights Electric Equipmen Misc. Electric Misc. Fuel Use	82606 t 171558 0 0	29.932 62.163 0.000 0.000	82606 171558 0 0	29.932 62.163 0.000 0.000
>>> Non-HVAC Tota	1 254165	92.095	254165	92.095
>>> GRAND TOTAL	1923999	697.152	1923999	697.152

^{*} Site Energy is the actual energy consumed.

^{*} Source Energy is the site energy divided by the electric generating efficiency of 100.0 %

^{*} Cost per unit floor area is based on the gross building floor area.

Building: 117-5. Mech Room & WCs BL 11-08-94 Weather: Hawthorne (Reno TMY) HAP v3.06 Prepared by: Keller & Gannon Page 1 of 1 ***************************

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	4977	1.803
Heating Loads	866002	313.792

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

Component	< Site (kBTU)	Energy *> (kBTU/sqft)*	< Source (kBTU)	Energy *> (kBTU/sqft)*
Electric Natural Gas Fuel Oil Propane	77903 0 1591931 0	28.228 0.000 576.828 0.000	77903 0 1591931	28.228 0.000 576.828 0.000
Remote Heating Remote Cooling	0 0	0.000 0.000	0 0	0.000 0.000
>>> HVAC Total	1669834	605.056	1669834	605.056
Electric Natural Gas Fuel Oil Propane Remote Heating	254165 0 0 0 0	92.095 0.000 0.000 0.000 0.000	254165 0 0 0 0	92.095 0.000 0.000 0.000 0.000
>>> Non-HVAC Tota	1 254165	92.095	254165	92.095
>>> GRAND TOTAL	1923999	697.151	1923999	697.151

^{*} Site Energy is the actual energy consumed.

* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %

Building: 117-5. Mech Room & WCs R1

Weather: Hawthorne (Reno TMY)

11-08-94 HAP v3.06

Prepared by: Keller & Gannon Page 1 of 1

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	4977	1.803
Heating Loads	633334	229.486

TABLE 2. ENERGY CONSUMPTION BY SYSTEM COMPONENT

Component		Energy *> (kBTU/sqft)*	< Source (kBTU)	Energy *> (kBTU/sqft)*
Air System Fans Cooling Plants Absorption Chille Heating Plants Pumps Cooling Towers	65944 1 rs 0 1165381 6840	23.895 0.000 0.000 422.270 2.479 0.000	65944 1 0 1165381 6840 0	23.895 0.000 0.000 422.270 2.479 0.000
>>> HVAC Total	1238167	448.644	1238167	448.644
Lights Electric Equipment Misc. Electric Misc. Fuel Use	82606 t 171558 0 0	29.932 62.163 0.000 0.000	82606 171558 0 0	29.932 62.163 0.000 0.000
>>> Non-HVAC Tota	1 254165	92.095	254165	92.095
>>> GRAND TOTAL	1492332	540.739	1492332	540.739

^{*} Site Energy is the actual energy consumed.

^{*} Source Energy is the site energy divided by the electric generating efficiency of 100.0 %

^{*} Cost per unit floor area is based on the gross building floor area.

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU) (kBTU/sqft)*		
Cooling Loads	4977	1.803	
Heating Loads	633334	229.486	

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

Component	< Site (kBTU)	Energy *> (kBTU/sqft)*	< Source (kBTU)	Energy *> (kBTU/sqft)*
Electric Natural Gas Fuel Oil Propane Remote Heating Remote Cooling	72847 0 1165321 0 0	26.396 0.000 422.248 0.000 0.000	72847 0 1165321 0 0 0	26.396 0.000 422.248 0.000 0.000
>>> HVAC Total	1238167	448.644	1238167	448.644
Electric Natural Gas Fuel Oil Propane Remote Heating	254165 0 0 0 0	92.095 0.000 0.000 0.000 0.000	254165 0 0 0 0	92.095 0.000 0.000 0.000 0.000
>>> Non-HVAC Tota	1 254165	92.095	254165	92.095
>>> GRAND TOTAL	1492332	540.739	1492332	540.739

^{*} Site Energy is the actual energy consumed.

^{*} Source Energy is the site energy divided by the electric generating efficiency of 100.0 %

^{*} Cost per unit floor area is based on the gross building floor area.

11-08-94 Building: 117-5. Mech Room & WCs R3 HAP v3.06

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TABLE 1. ANNUAL COIL LOADS

Component	(kBTU) (kBTU/sqft) *		
Cooling Loads	5103	1.849	
Heating Loads	203225	73.638	

TABLE 2. ENERGY CONSUMPTION BY SYSTEM COMPONENT

Component	< Site (kBTU)	Energy *> (kBTU/sqft) *	< Source (kBTU)	
Air System Fans Cooling Plants Absorption Chille Heating Plants Pumps Cooling Towers	68396 1 rs 0 369488 6840	24.783 0.000 0.000 133.882 2.479 0.000	68396 1 0 369488 6840 0	24.783 0.000 0.000 133.882 2.479 0.000
>>> HVAC Total	444725	161.144	444725	161.144
Lights Electric Equipmen Misc. Electric Misc. Fuel Use	82606 t 171558 0	29.932 62.163 0.000 0.000	82606 171558 0 0	29.932 62.163 0.000 0.000
>>> Non-HVAC Tota	1 254165	92.095	254165	92.095
>>> GRAND TOTAL	698890	253.239	698890	253.239

^{*} Site Energy is the actual energy consumed.

Gross floor area..... 2760 sqft Conditioned floor area....: 2760 sqft

^{*} Source Energy is the site energy divided by the electric

generating efficiency of 100.0 % * Cost per unit floor area is based on the gross building floor area.

Building: 117-5. Mech Room & WCs R3 11-08-94

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*	
Cooling Loads	5103	1.849	
Heating Loads	203225	73.638	

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

Component	< Site (kBTU)	Energy *> (kBTU/sqft)*	< Source (kBTU)	Energy *> (kBTU/sqft)*
Electric Natural Gas Fuel Oil Propane Remote Heating Remote Cooling	75256 0 369469 0 0	27.269 0.000 133.875 0.000 0.000	75256 0 369469 0 0	27.269 0.000 133.875 0.000 0.000
>>> HVAC Total	444725	161.144	444725	161.144
Electric Natural Gas Fuel Oil Propane Remote Heating	254165 0 0 0 0	92.095 0.000 0.000 0.000 0.000	254165 0 0 0 0	92.095 0.000 0.000 0.000 0.000
>>> Non-HVAC Tota	1 254165	92.095	254165	92.095
>>> GRAND TOTAL	698890	253.239	698890	253.239

^{*} Site Energy is the actual energy consumed.

Gross floor area..... 2760 sqft Conditioned floor area....: 2760 sqft

^{*} Source Energy is the site energy divided by the electric generating efficiency of 100.0 %

^{*} Cost per unit floor area is based on the gross building floor area.

Building: 117-3. Control Room Area Insul

Weather: Hawthorne (Reno TMY) Prepared by: Keller & Gannon

02-08-95 HAP v3.06

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TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft) *
Cooling Loads	48684	28.453
Heating Loads	52258	30.542

TABLE 2. ENERGY CONSUMPTION BY SYSTEM COMPONENT

Component		<pre>Energy *> (kBTU/sqft) *</pre>	< Source (kBTU)	Energy *> (kBTU/sqft) *
Air System Fans Cooling Plants Absorption Chille Heating Plants Pumps	79829 16942	15.496 9.228 0.000 46.656 9.902	26514 15789 0 79829 16942	15.496 9.228 0.000 46.656 9.902
Cooling Towers	139073	0.000 81.282	139073	0.000 81.282
Lights Electric Equipmen Misc. Electric Misc. Fuel Use	68896 t 76064 0	40.266 44.456 0.000 0.000	68896 76064 0	40.266 44.456 0.000 0.000
>>> Non-HVAC Tota	1 144960	84.722	144960	84.722
>>> GRAND TOTAL	284033	166.004	284033	166.004

^{*} Site Energy is the actual energy consumed.

Conditioned floor area....: 1711 sqft

^{*} Source Energy is the site energy divided by the electric generating efficiency of 100.0 %

^{*} Cost per unit floor area is based on the gross building floor area.

Building: 117-3. Control Room Area Insul

Weather: Hawthorne (Reno TMY)

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Prepared by: Keller & Gannon Page 1 of 1

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU) (kBTU/s	
Cooling Loads	48684	28.453
Heating Loads	52258	30.542

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

Component	< Site (kBTU)	Energy *> (kBTU/sqft)*	< Source (kBTU)	Energy *> (kBTU/sqft)*
Electric	59249	34.628	59249	34.628
Natural Gas	0	0.000	0	0.000
Fuel Oil	79825	46.654	79825	46.654
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
Remote Cooling	0	0.000	0	0.000
>>> HVAC Total	139073	81.282	139073	81.282
Electric	144960	84.722	144960	84.722
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
>>> Non-HVAC Tota	al 144960	84.722	144960	84.722
>>> GRAND TOTAL	284034	166.004	284034	166.004

^{*} Site Energy is the actual energy consumed.

^{*} Source Energy is the site energy divided by the electric generating efficiency of 100.0 %

^{*} Cost per unit floor area is based on the gross building floor area.

Building: 117-3. Work Areas Insulated

Weather: Hawthorne (Reno TMY)

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Prepared by: Keller & Gannon ****************

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	510610	54.893
Heating Loads	27890	2.998

TABLE 2. ENERGY CONSUMPTION BY SYSTEM COMPONENT

Component	< Site (kBTU)	Energy *> (kBTU/sqft)*	< Source (kBTU)	<pre>Energy *> (kBTU/sqft) *</pre>
Air System Fans Cooling Plants Absorption Chille: Heating Plants Pumps Cooling Towers	63736 72723 rs 0 35998 56755	6.852 7.818 0.000 3.870 6.101 0.000	63736 72723 0 35998 56755 0	6.852 7.818 0.000 3.870 6.101 0.000
>>> HVAC Total	229212	24.641	229212	24.641
Lights Electric Equipment Misc. Electric Misc. Fuel Use	266135 t 1215471 0 0	28.610 130.668 0.000 0.000	266135 1215471 0 0	28.610 130.668 0.000 0.000
>>> Non-HVAC Tota	l 1481606	159.278	1481606	159.278
>>> GRAND TOTAL	1710817	183.919	1710817	183.919

^{*} Site Energy is the actual energy consumed.

Gross floor area..... 9302 sqft Conditioned floor area..... 9302 sqft

^{*} Source Energy is the site energy divided by the electric

generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.

Building: 117-3. Work Areas Insulated

02-08-95 Weather: Hawthorne (Reno TMY) HAP v3.06

Prepared by: Keller & Gannon Page 1 of 1 ******************

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*	
Cooling Loads	510610	54.893	
Heating Loads	27890	2.998	

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

Component	< Site (kBTU)	Energy *> (kBTU/sqft)*	< Source (kBTU)	<pre>Energy *> (kBTU/sqft) *</pre>
Electric Natural Gas	193216	20.771	193216	20.771
Fuel Oil	35996	0.000 3.870	0 35996	0.000 3.870
Propane Remote Heating	0	0.000 0.000	0 0	0.000 0.000
Remote Cooling	0	0.000	0	0.000
>>> HVAC Total	229212	24.641	229212	24.641
Electric Natural Gas	1481606	159.278 0.000	1481606	159.278 0.000
Fuel Oil	0	0.000	0	0.000
Propane Remote Heating	0	0.000	0	0.000 0.000
>>> Non-HVAC Tota	1 1481606	159.278	1481606	159.278
>>> GRAND TOTAL	1710818	183.919	1710818	183.919

^{*} Site Energy is the actual energy consumed.

Gross floor area....: 9302 sqft Conditioned floor area....: 9302 sqft

^{*} Source Energy is the site energy divided by the electric generating efficiency of 100.0 %

^{*} Cost per unit floor area is based on the gross building floor area.

Building: 117-3. Mechanical Room Insul.

02-08-95 HAP v3.06

Weather: Hawthorne (Reno TMY)

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Prepared by: Keller & Gannon ************

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	0	0.000
Heating Loads	501282	170.272

TABLE 2. ENERGY CONSUMPTION BY SYSTEM COMPONENT

Component		Energy *> (kBTU/sqft)*	< Source (kBTU)	Energy *> (kBTU/sqft)*
Air System Fans	50989	17.320	50989	17.320
Cooling Plants Absorption Chille	0 rs 0	0.000 0.000	0	0.000 0.000
Heating Plants Pumps	841041 54214	285.680 18.415	841041 54214	285.680 18.415
Cooling Towers	0	0.000	0	0.000
>>> HVAC Total	946244	321.414	946244	321.414
Lights Electric Equipmen Misc. Electric Misc. Fuel Use	57653 t 615955 0	19.583 209.224 0.000 0.000	57653 61 5955 0 0	19.583 209.224 0.000 0.000
>>> Non-HVAC Tota	1 673607	228.807	673607	228.807
>>> GRAND TOTAL	1619851	550.221	1619851	550.221

^{*} Site Energy is the actual energy consumed.

Gross floor area..... 2944 sqft 2944 sqft Conditioned floor area....:

^{*} Source Energy is the site energy divided by the electric generating efficiency of 100.0 %

^{*} Cost per unit floor area is based on the gross building floor area.

Building: 117-3. Mechanical Room Insu:.

02-08-95 HAP v3.06

Weather: Hawthorne (Reno TMY)
Prepared by: Keller & Gannon

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TABLE 1. ANNUAL COIL LOADS

Component	onent (kBTU) (kBTU	
Cooling Loads	0	0.000
Heating Loads	501282	170.272

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

Component	< Site (kBTU)	Energy *> (kBTU/sqft)*	< Source (kBTU)	Energy *> (kBTU/sqft)*
Electric Natural Gas	105247	35.750	105247	35.750
Fuel Oil	0 840997	0.000 285.665	840997	0.000 285.665
Propane Remote Heating	0	0.000 0.000	0	0.000 0.000
Remote Cooling	0	0.000	0	0.000
>>> HVAC Total	946244	321.414	946244	321.414
Electric Natural Gas	673607	228.807	673607	228.807
Fuel Oil	0	0.000 0.000	0	0.000 0.000
Propane Remote Heating	0	0.000 0.000	0 0	0.000 0.000
>>> Non-HVAC Tota	1 673607	228.807	673607	228.807
>>> GRAND TOTAL	1619851	550.221	1619851	550.221

^{*} Site Energy is the actual energy consumed.

Gross floor area..... 2944 sqft Conditioned floor area....: 2944 sqft

^{*} Source Energy is the site energy divided by the electric generating efficiency of 100.0 %

^{*} Cost per unit floor area is based on the gross building floor area.

Building: 117-5. Work Room HVAC Insul.

02-08-95 HAP v3.06

Weather: Hawthorne (Reno TMY)

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Prepared by: Keller & Gannon **************

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	182927	49.722
Heating Loads	22900	6.225

TABLE 2. ENERGY CONSUMPTION BY SYSTEM COMPONENT

Component		Energy *> (kBTU/sqft)*	< Source (kBTU)	Energy *> (kBTU/sqft)*
Air System Fans Cooling Plants Absorption Chille Heating Plants Pumps Cooling Towers	123887 83163 ers 0 38022 14461	33.674 22.605 0.000 10.335 3.931 0.000	123887 83163 0 38022 14461	33.674 22.605 0.000 10.335 3.931 0.000
>>> HVAC Total	259533	70.544	259533	70.544
Lights Electric Equipmen Misc. Electric Misc. Fuel Use	261980 t 440049 0	71.210 119.611 0.000 0.000	261980 440049 0 0	71.210 119.611 0.000 0.000
>>> Non-HVAC Tota	1 702029	190.821	702029	190.821
>>> GRAND TOTAL	961563	261.365	961563	261.365

^{*} Site Energy is the actual energy consumed.

Gross floor area..... 3679 sqft Conditioned floor area....: 3679 saft

^{*} Source Energy is the site energy divided by the electric generating efficiency of 100.0 %

^{*} Cost per unit floor area is based on the gross building floor area.

Building: 117-5. Work Room HVAC Insul.

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Weather: Hawthorne (Reno TMY) Prepared by: Keller & Gannon

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TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads Heating Loads	182927 22900	49.722 6.225

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

Component	< Site (kBTU)	Energy *> (kBTU/sqft)*	< Source (kBTU)	Energy *> (kBTU/sqft)*
Electric	221513	60.210	221513	60.210
Natural Gas	0	0.000	0	0.000
Fuel Oil	38020	10.334	38020	10.334
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
Remote Cooling	0	0.000	0	0.000
>>> HVAC Total	259533	70.544	259533	70.544
Electric	702029	190.821	702029	190.821
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
>>> Non-HVAC Tota	1 702029	190.821	702029	190.821
>>> GRAND TOTAL	961563	261.365	961563	261.365

^{*} Site Energy is the actual energy consumed.

Gross floor area....: 3679 sqft Conditioned floor area....: 3679 sqft

^{*} Source Energy is the site energy divided by the electric generating efficiency of 100.0 %

^{*} Cost per unit floor area is based on the gross building floor area.

Building: 117-5. Mech Room & WCs Insul.

02-08-95 HAP v3.06

Weather: Hawthorne (Reno TMY) Prepared by: Keller & Gannon

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TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	5416	1.962
Heating Loads	128103	46.417

TABLE 2. ENERGY CONSUMPTION BY SYSTEM COMPONENT

Component		Energy *> (kBTU/sqft) *	< Source (kBTU)	<pre>Energy *> (kBTU/sqft) *</pre>
Air System Fans	68404	24.786	68404	24.786
Cooling Plants	1	0.001	1	0.001
Absorption Chille	rs 0	0.000	0	0.000
Heating Plants	231111	83.742	231111	83.742
Pumps	6835	2.477	6835	2.477
Cooling Towers	0	0.000	0	0.000
>>> HVAC Total	306352	111.005	306352	111.005
Lights	82606	29.932	82606	29.932
Electric Equipmen	t 171558	62.163	171558	62.163
Misc. Electric	0	0.000	0	0.000
Misc. Fuel Use	0	0.000	0	0.000
>>> Non-HVAC Tota	1 254165	92.095	254165	92.095
>>> GRAND TOTAL	560516	203.100	560516	203.100

^{*} Site Energy is the actual energy consumed.

Gross floor area..... 2760 sqft Conditioned floor area..... 2760 sqft

^{*} Source Energy is the site energy divided by the electric generating efficiency of 100.0 %

^{*} Cost per unit floor area is based on the gross building floor area.

Building: 117-5. Mech Room & WCs Insul. 02-0
Weather: Hawthorne (Reno TMY) HAP v
Prepared by: Keller & Gannon Page 1 o

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft) *	
Cooling Loads	5416	1.962	
Heating Loads	128103	46.417	

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

Component	< Site (kBTU)	Energy *> (kBTU/sqft)*	< Source (kBTU)	Energy *> (kBTU/sqft)*
Electric	75253	27.267	75253	27.267
Natural Gas	0	0.000	0	0.000
Fuel Oil	231099	83.738	231099	83.738
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
Remote Cooling	0	0.000	0	0.000
>>> HVAC Total	306352	111.005	306352	111.005
Electric	254165	92.095	254165	92.(
Natural Gas	0	0.000	0	0.1
Fuel Oil	0	0.000	0	0.1
Propane	0	0.000	0	0.1
Remote Heating	0	0.000	0	0.1
>>> Non-HVAC Tota	1 254165	92.095	254165	92.
>>> GRAND TOTAL	560516	203.100	560516	203.100

^{*} Site Energy is the actual energy consumed.

^{*} Source Energy is the site energy divided by the electric generating efficiency of 100.0 %

^{*} Cost per unit floor area is based on the gross building floor area.